July-August 1993

3

PROGRAM MANAGER

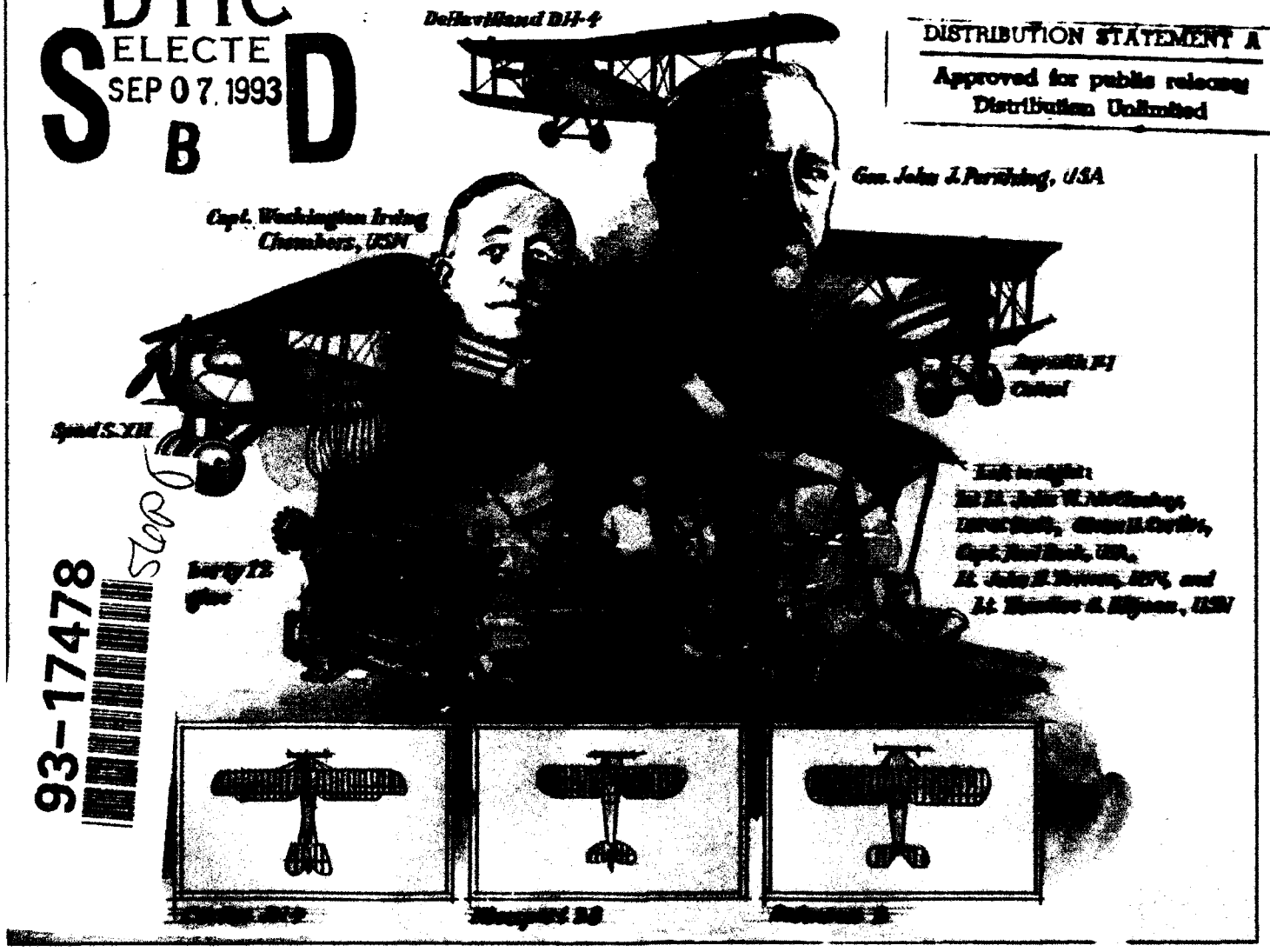
Journal of the Defense Systems Management College

Work Breakdown Structure

Acquisition Law Panel

Changing Role of Government Laboratories

Wright Brothers Through the Great War



PROGRAM MANAGER

Journal of the Defense Systems Management College

VOL. XXII, No. 4, DSMC 115

Published by the
DEFENSE SYSTEMS MANAGEMENT COLLEGE PRESS

Commandant
BGen (Sel) Claude M. Bolton, Jr., USAF

Acting Provost and Deputy Commandant
Edward Hirsch

Executive Director
Research and Information Division
Dr. Adelia E. Ritchie

Director, DSMC Press
Wilbur D. Jones, Jr.

PROGRAM MANAGER

Managing Editor
Catherine M. Clark

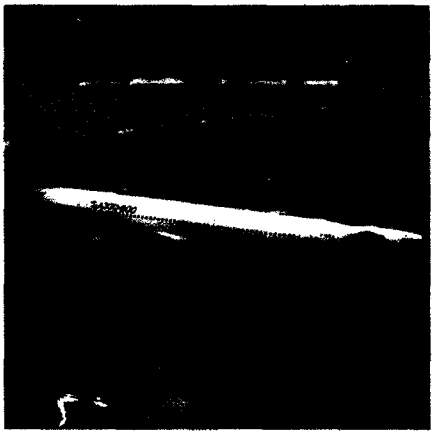
Associate Editor
Esther M. Farria

Art Director
Greg Caruth

Typography and Design
Paula Croisetiere

Program Manager (ISSN 0199-7114) is published bimonthly by the Defense Systems Management College, Fort Belvoir, VA 22060-5426. Non-government employees and organizations may subscribe at $9.50 annually through the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Second class postage paid at Fort Belvoir, VA, and at additional entry offices.

POSTMASTER: Send address changes to *Program Manager*, Defense Systems Management College, Fort Belvoir, VA 22060-5426.



For sale by the Superintendent of Documents, U.S. Government Printing Office Washington, DC 20402

Whenever masculine nouns or pronouns appear, other than with obvious reference to named male individuals, they have been used for literary purposes and are meant in their generic sense.

Cover Art:

The cover art montage created by DSMC also appears on pages 10-11. Sources of the drawings are Naval Historical Center photographs for Gen. John J. Pershing; the DeHavilland DH-4; and the group of Glenn H. Curtiss, 1st Lt. John W. McClaskey, USMC (Ret.), Capt. Paul Beck, USA, Lt. John H. Towers and Lt. Theodore G. Ellyson. The source for Captain Washington Irving Chambers is a National Archives photograph.

ALSO:

Program Manager is intended to be a vehicle for the transmission of information on policies, trends, events, and current thinking affecting program management and defense systems acquisition. Statements of fact or opinion appearing in *Program Manager* are solely those of the authors and are not necessarily endorsed by the Department of Defense or the Defense Systems Management College. Unless copyrighted, articles may be reprinted. When reprinting, please credit the author and *Program Manager*, and forward two copies of the reprinted material to the DSMC Press.

To subscribe, government personnel should submit written requests (using their business addresses) to the DSMC Press, RD-P, Ft. Belvoir, VA 22060-5426.

Manuscripts, Letters to the Editor, and other correspondence are welcome and should be addressed to the DSMC Press. Inquiries concerning proposed articles may be made by phone at (703) 805-2892/3056 or DSN 655-2892/3056.

DR. DEUTCH RESTRUCTURES DEFENSE ACQUISITION ORGANIZATION

On May 19, 1993, Dr. John M. Deutch, Under Secretary of Defense (Acquisition and Technology), annouced a major reorganization of the acquisition management structure in the Department of Defense. His comments follow. (See the center pages of *Program Manager* for the new organization chart.)

"Since taking office, I have been working with the Secretary and the Deputy Secretary, and my staff to realign acquisition and technology functions to focus on the Department's changing mission to strengthen Acquisition Reform, Environmental Security, Advanced Technology Demonstration Management, Logistics, and Economic Security. Effective immediately, the following realignments will be implemented.

"The USD(Acquisition) title will be changed to USD(Acquisition and Technology) to emphasize the importance of the technology function in the acquisition process.

"The Principal Deputy Under Secretary will be my chief advisor, act in my absence, and oversee the DAB and DAES related functions to eliminate the two step review process for the day-to-day issues related to systems acquisition. The Director (Defense Procurement), Director (Acquisition Program Integration), Director (Test and Evaluation), Director (Computer-Aided Acquisition and Logistics Support and Electronic Data Interchange), Director (Tactical Systems), Director (Strategic and Space Systems), and the ASD(C3I) Committee for acquisition matters, will report to the PDUSD(AT&T).

"The Assistant Secretary of Defense (Economic Security) will be responsible for setting policies for Economic Reinvestment, BRAC, Dual-Use Technology, International Programs, Industrial Base, and community relations. It is expected that internal changes will take place when the new ASD(ES) is in place. In the interim, the ASD(P&L) will continue to operate as in the past in these areas, providing matrix support to the other elements as necessary. The ASD(ES) will provide guidance to the DIR(SADBU) concerning small business opportunities in relation to OUSD(A) economic initiatives. The Office of Economic Adjustment (OEA) will report to the ASD(ES).

"The Deputy Under Secretary of Defense (Acquisition Reform) will identify and implement ways to improve the Acquisition processes, both within the Department's infrastructure, and between the Department and its suppliers. The Director (Acquisition Education, Training and Career Development); the President (Defense Acquisition University); and the Commandant (Defense Systems Management College) will report to the DUSD(AR).

"The Deputy Under Secretary of Defense (Environmental Security) is established to increase the awareness and emphasis on environmental issues throughout the Department in the areas of environmental compliance, clean-up, pollution prevention, and energy conservation. The DASD (Environmental Technology) and the DASD (Installations) will report to the DUSD(ES).

"The Deputy Under Secretary of Defense (Advanced Technology) will focus on Ballistic Missile Defense as embodied in the Strategic Defense Initiative Office. The DUSD(AT) will provide guidance to the Director (SDIO) in this area. The Office of the Thrust Leaders will report to the DUSD(AT).

"The Deputy Under Secretary of Defense (Logistics) will oversee all aspects of Logistics, as they arise in significance when force levels decline. All existing DASD(Logistics) offices and the Logistics Systems Development Directorate will report to the DUSD(L).

"The Director Defense Research and Engineering will focus on oversight and management of DOD Scientific matters, basic and applied research; and laboratory research and management in the development of weapon systems. The Director, Advanced Research Projects Agency (ARPA) will report to the DDR&E.

"The Assistant to the Secretary of Defense for Atomic Energy in addition to current duties will have responsibility for oversight of the On-Site Inspection Agency and the Defense Nuclear Agency. The ATSD(AE) will report to the USD(AT&T).

"We are working with the Director, Administration and Management to make appropriate changes to charters, realign manpower and resources and accomplish necessary personnel actions. I look forward to your continued cooperation and support during this reorganization effort."

THE WORK BREAKDOWN STRUCTURE

It's Much More Than a Cost-Reporting Structure

Dr. Jerry Lake

Concern about the format and uses of work breakdown structures in engineering began to surface in the early 1990s. Several events stimulated interest. First, the F-22 program office attempted to utilize the work breakdown structure (WBS) for managing program product and process development. According to an Air Force Process Interface Document on Cost Management Interface, the F-22 program manager found that predetermined WBSs in MIL-STD-881, a standard on WBSs for defense material items, sometimes conflicted with needed engineering based structure. The program manager found that approval authorities in the Pentagon were reluctant to approve his deviations from the WBS standard.

The WBS became a tool of interest to the systems engineering community with inclusion in Section 6 (Engineering and Manufacturing), Part A (Systems Engineering) and Part B (Work Breakdown Structures) of DoDI 5000.2 of the requirement for development and use of WBSs in a system acquisition. Third, the WBS became a focal tool for implementation of several essential requirements of MIL-STD-499B (For Coordination Draft, May 6, 1992), a revised systems engineering standard.[1]

William Maher, in his 1992 article in *Program Manager* on "Cutting a Path to Quality through Concurrent Teamwork," recognized the need for a new look at using the 881 WBS. His approach was primarily focused on enhancing software integration with a product focus.

In a recent briefing, by a consultant involved with preparing MIL-STD-881, program managers were exhorted to "allow the WBS to work for your program — don't rework the WBS to fit your program." An axiom of this paper is the opposite, that the technical effort is accomplished according to overall program needs, not to a WBS built primarily to accomplish business-related purposes.

In an attempt to determine what use the engineering community makes of the WBS, I queried 12 training classes. Several interesting observations resulted. First, from a sample of 77 industry and government practicing engineers attending two systems engineering training classes, none recognized the WBS as one of the important engineering related documents in a contract. Second, from more than ten sections in the Defense Systems Management College Program Management Course (PMC) (nearly 300 systems acquisition experienced students), it was found that few programs have used the WBS for assisting in the preparation of statements of work, managing interfaces, assessing risks, or evaluating engineering change proposals. Third, from students questioned, only a few knew that the basic development source of the initial WBS should be the specification tree created by engineers. The attitude of engineers with respect to the WBS can be summarized by the words of a practicing engineer and PMC student. He said that in most audiences with business and engineering personnel, when the topic of WBS comes up, engineers leave the room.

It is my purpose to make the engineering community aware of the importance of the WBS to the engineering effort and its central role in accomplishing world-class systems engineering. The differences are highlighted between the requirements of the WBS standard and the WBS needed to get world-class systems engineering accomplished. Recommen-

---

***EDITOR'S NOTE**: The views expressed herein are the author's and do not reflect the official policy or position of the Department of Defense or the U.S. Government.*

Dr. Lake is a Professor of Systems Engineering at the Defense Systems Management College. He is a principal writer of the draft military standard of systems engineering, MIL-STD-499B.

dations to resolve these differences are provided.

Engineering WBS Basics

A work breakdown structure has an intended use as a basis for communication throughout the life cycle of a system. It must be useful to the business community in preparing budgets and cost estimates and for collecting and analyzing costs for cost performance reports. It must be useful to contract management for identifying contract line items and data deliverables. And the WBS must be useful to the engineering development effort to:

—Show a breakdown of the hardware, software, functions/services and tasks required of the engineering effort

—Provide a framework for relating statement of work, technical performance measures, systems engineering masters schedule events, systems engineering detailed schedule times, contract delivery items, configuration items, technical and management reports and system elements

—Show subcontracting tasks at proper WBS level

—Assign management and technical responsibilities for specific items or areas

—Allow organizational interfaces to accomplish the tasks to be performed

—Assist in risk identification, interface management, configuration management, data management, trade studies, effectiveness assessments and progress reviews

—Provide assistance in developing and evaluating engineering change proposals and specification change notices

—Provide a framework for planning, budgeting, scheduling, authorizing of work orders and material/part ordering, performance measuring and reporting.

The WBS, therefore, must be useful to the business and engineering communities in providing a road map for the concurrent management of a program. The WBS must be applicable to all size contracts including advanced studies and research projects. (In the two latter cases, the WBS may be more of a task breakdown than a product/service breakdown structure.)

A WBS is made up of two major parts, a product part and a process part. The product part can be thought of as defining the vertical aspects of the WBS. The product part is depicted by the shaded elements of Figure 1. This vertical aspect portrays the product structure that, when all elements are integrated, satisfies the operational function of the system. This structure is defined by specifications.

The process part of the system is made up of the development efforts associated with enabling the development, production, verification, and support of the product part of the system, as well as development efforts associated with enabling the training of the personnel involved with operations and support of the product part. The process part can be thought of as defining the horizontal aspect of the WBS. The process part is depicted in Figure 1 as the second level elements (not shaded) that make the products (shaded elements) of the second and third levels of the WBS possible. This structure reflects system products and the associated lifecycle processes identified with a balanced system development using concurrent engineering principles and the primary functions of MIL-STD-499B.

For a particular system concept (e.g., an aircraft, ship, missile) that satisfies the operational need, a system specification is drafted and a specification tree is framed. This allows the top three levels of a preliminary program WBS to be designated. Normally this is accomplished during the concept definition level of development. The top three levels of Figure 1 illustrate a possible program WBS for an aircraft system useful for planning and controlling system developmental efforts. Such a structure is called an engineering work breakdown structure (EWBS). The program structure depicts the system (aircraft), the prime mission equipment (air vehicle), three of several possible products (e.g., air frame, propulsion, and fire control subsystems) and five major process segments (systems engineering and

FIGURE 1. Aircraft System Engineering WBS

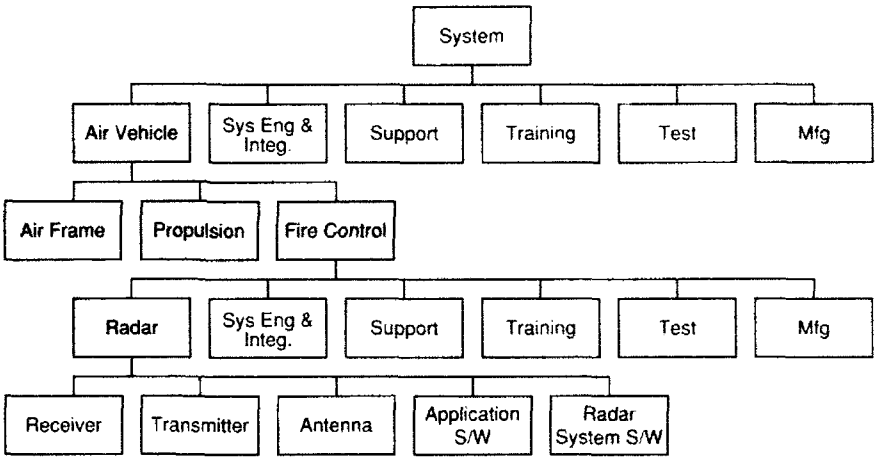


FIGURE 2. Work Breakdown Structure Dictionary

Work Breakdown Dictionary

Index Item No. 2		WBS Level 2		CONTRACT NUMBER F33657-72-0923
WBS Element		WBS Title		Contract Line Item: 0001, 0001AA, 0001AB, 0001Ac, 0001AD, 0001AE, 0001AF, 0001AG, 0001AH
Date	Revision No.	Revision Auth	Approved Chg	
Specification No. 689E078780028	Specification Title: Prime Item Development Specification for XXX Air Vehicle			

Element Task Description

Technical Content

The air vehicle element task description refers to the effort required to design, develop, fabricate and test the airframe segment, propulsion element, and fire control element, and to the integration assembly and check-out of these complete elements, to produce the complete Air Vehicle. The lower level elements included and summarized in the Air Vehicle element are:

Airframe Segment (A11100),
Propulsion Segment (A32100), and
Fire Control Segment (A61200).

Cost Description

MPC PMC	Work Order Work Auth
A10100	See lower level WBS Elements

Cost Content - System Contractor

The cost to be accumulated against this element include a summarization of all costs required to plan, design, develop, fabricate, assemble, integrate and perform development testing, analysis and reporting for the air vehicle. It also includes all costs associated with the required efforts in integrating, assembling and checking our GFP required to create this element.

Applicable SOW Paragraph: 3.6.2

integration, support, training, test and manufacturing). The support element includes (at the next breakout level) deployment/installation and disposal, the other two primary functions related to a system. This initial structure provides a tool to aid management in determining the scope of the effort, an estimate of funds needed, and the extent of contractual and/or organizational support needed.

A preliminary program EWBS is provided to potential system developers (government or contractor agencies) in a request for proposal (RFP) to be used as a basis for preparing proposal responses and for developing agency and contractor negotiations. It is also used by the government developer to prepare a statement of work (SOW), to structure data call responses, and for preparing the government event based schedule (a systems engineering master schedule or SEMS).

As specifications for successive levels of the physical architecture are defined through application of the systems engineering process, lower elements of the EWBS are identified. Each level of the WBS enables better definition of contract/organizational roles, product and process responsibilities and tasks, and relationships to other elements and subelements. The initial extension of the program EWBS is the responsibility of the developing agency and normally reflects no more than two additional levels below the subsystem level, except for high-cost or high-risk elements that may be broken down an additional level. For example, the radar system software element might be further broken down to computer software configuration items such as a display and control unit, computer unit, and back bus unit. Extensions provide the basis for approving the program WBS and for preparing preliminary contract WBSs to be used for the subsystem level of development.

The lower levels of Figure 1 illustrate a potential preliminary contract EWBS for the fire control element of the aircraft program EWBS. Like the program EWBS, the contract EWBS has a product part (radar, receiver, transmitter, antenna, application software and radar system software) for the fire control and a process part with identical elements as the program EWBS. In this case, however, the process part elements include developmental efforts associated with enabling the development, production, verification and support of the radar products that make up the fire control subsystem.

Each contract EWBS would be extended by the contractor for the subsystem specified in the contract to the lowest performance level needed to plan, schedule and implement task responsibilities for successive levels of development (e.g., preliminary design, detailed design and fabrication, assembly and test of developmental test items, and eventual production of end-items).

The primary purposes of the extended contract EWBS include:

—Displaying the total development work

—Determining the cost for each task as defined in the SOW

—Providing performance measurement and visibility into physical and budgeting progress

—Assisting in risk identification, and configuration, data, and interface management

—Assisting in assigning organizational responsibilities

—Providing identification of hardware and software configuration items.

The cost of each element of the EWBS can be estimated based on the projected or actual work that must be done to accomplish the development of that element and associated data and deliverables. Budgets for each element and for major segments of the system as well as for the system itself can be prepared using this structure. As costs are accumulated against EWBS elements (by team or organizational elements or both), manage-

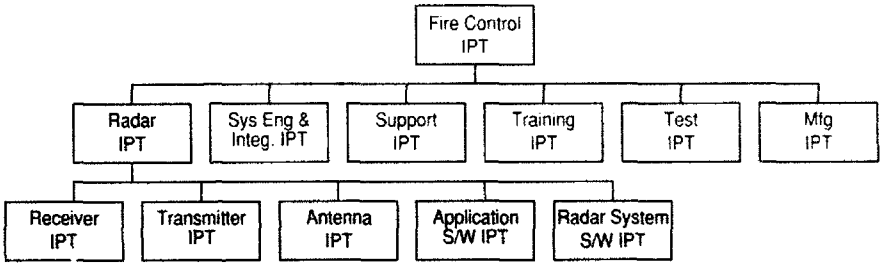
ment (team or organizational) can determine, for example, whether the cost of developing the principal equipment item, or any associated process part, or the total contract end-item, is too high. By separating the work into principal product items, systems engineering and integration, support, etc., management can track back down the EWBS to identify problem sources and evaluate organizational performance based on variances between planned and actual accomplishments. It can also monitor schedules and costs, track critical performance parameters, and make trade-offs and other cost, schedule, performance and/or risk adjustments as needed to meet established objectives. Additionally, contract line items (CLINs) and contract data requirements lists (CDRLs) can be identified easily with specific products and associated processes. This assists engineering and contract management in preparing the request for proposal (RFP).

A well-prepared EWBS and a well-prepared task description for each EWBS element is imperative. Figure 2 provides an example WBS task description for the air vehicle segment in Figure 1. This type of description enables the preparer of, and a responder to, a SOW to fully understand the work content of a WBS element. The government developing agency should include such a WBS dictionary down to level three of the contract EWBS. The contractor should then prepare, for his proposal response, a dictionary for each element to a level specified in the RFP. This enables a common understanding to be ascertained by the contractor and the developing agency as to the specifics of the work that will be done.

Another basic idea of the WBS is that it does not require a contractor to perform or deliver a particular specialty of engineering (e.g., mechanical, electrical, safety) or any other function (e.g., manufacturing). Instead, the WBS identifies a certain service or product for which the contractor must develop technical requirements and design solutions along with accompanying supporting documents. The contractor uses particular engineering specialties and accomplishes certain functions to complete required development activities. The specialists and the work performed can be organized in a way suited to the contractor, to the work effort, and to the contract.

A recommended organizational approach is by integrated product teams. The EWBS provides a convenient structure for assigning teams to specific product development efforts, as well as a convenient structure for collecting cost, assessing risks, evaluating engineering change proposals and for accomplishing incremental design reviews. Integrated product teams and incremental reviews are discussed next using the EWBS structure of Figure 1.

FIGURE 3. Integrated Product Team Organization

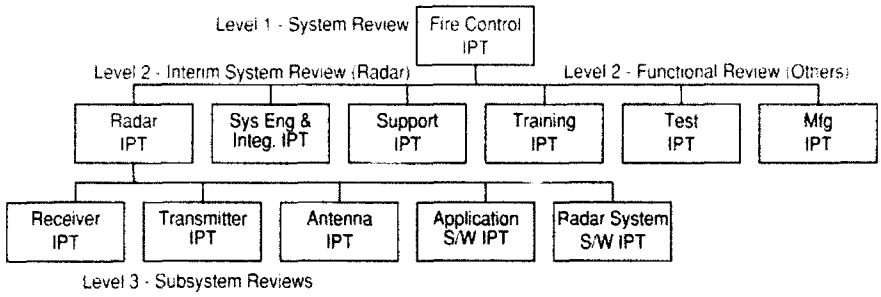


Engineering WBS Applications

Integrated Product Teams. The basic tenet of an integrated product team (IPT) is described in an Air Force Material Command White Paper on Integrated Product Development prepared in February 1993. It describes a team as the right people brought together at the right place and at the right time. The right people will vary depending on the level of development and the WBS element. Early in the development only a few IPTs may be needed. The best life-cycle decisions are made when the team has the appropriate representatives from engineering, manufacturing, logistics, financial management, contracting and any other appropriate discipline, to include customers and suppliers. The goal is to increase up-front planning and activities to integrate and concurrently apply all necessary processes to develop an effective and efficient product that will satisfy customer needs. A recommended IPT structure for fire control subsystem development is depicted in Figure 3. For this example, the IPTs are assigned to the products of level 3, the receiver, transmitter, etc. The leaders, or primary hardware/software team members from the level 3 IPTs, would make up the radar IPT. Each process team would be composed of those team members from that functional area represented on the level-3 product teams. These teams would be supplemented by other disciplines to ensure the development of the needed hardware, software and other system elements needed to provide the functional support to the radar and its products at level 3 that when fabricated/coded, assembled and integrated will make up the radar. The fire control IPT would be made up of the leaders from all level-2 IPTs. This role up of lower-level team leaders into higher-level IPTs, or team of teams, helps resolve interface issues and ensure integration of all products and processes for the system under development.

Each IPT is assigned to one product of the WBS and held responsible for its development. With respect to that WBS product, the team, to be effective, must be given: 1) responsi-

FIGURE 4. Incremental Reviews Using the Engineering WBS



bility to meet allocated specifications (including integration with interfacing products and processes); 2) authority to accomplish the development (SOW) tasks needed; 3) budgeted resources to manage the product and its risk; and 4) accountability for the results of their effort.

For example, the manufacturing IPT would be made up of the manufacturing representatives from the radar subsystem product teams, and other team members as appropriate. This process-oriented IPT would be responsible to ensure that the system elements (hardware, software, facilities, techniques, etc.) required for fabrication and assembly of engineering test models, brassboards, low-rate initial-production, and full-rate production of level-3 equipments are available when needed and that they will be cost-effective. The team thus provides for the definition of manufacturing methods and/or processes, including assembly and checkout; and for the development of fabrication component elements including test equipment, tooling, machinery and manufacturing layouts. Neither this WBS element, nor IPT responsibility, includes the actual efforts involved with fabrication, assembly or checkout. These efforts are completed by other organizational entities at the appropriate level (e.g., the work package level or an integration level) of the extended WBS and that are associated with a level-3 product element.

Incremental Reviews. Another use of the EWBS is to facilitate the incremental technical reviews outlined in MIL STD-499B. In addition to major system level reviews, three types of incremental reviews are designated: Subsystem, Functional, and Interim System. The intent is to provide sufficient structure to ensure that requirements and design decisions are made in a multidisciplinary environment as well as to provide a framework for effective planning to execute required accomplishments. The subsystem, functional and interim system reviews are oriented toward ensuring that each configuration item (CI) has met its systems engineering event based accomplishment criteria and other contractual requirements.

The application of the three types of incremental reviews is discussed below based on the structure of Figure 4.

Subsystem Reviews. Subsystem reviews are completed by the IPT assigned to a level-3 WBS element (CI). Team membership reflects all functional areas and technical disciplines needed to address life-cycle requirements and actions to satisfy those requirements. Team members include core and extended representatives from government disciplinary (users and suppliers) and contractor and subcontractor disciplinary organizations involved in developing the subsystem. These reviews are typically referred to as a CI software specification review, preliminary design review, critical design review, functional configuration audit or physical configuration audit. In addition, hardware and software test readiness reviews would be held to ensure each product is ready for test. And, production readiness reviews could be held to determine each product's readiness for production. These latter tests could be held in conjunction with the appropriate process IPT. Subsystem reviews below the CI level are normally held as technical interchange meetings (TIMs) or other working group meetings.

Functional Reviews. Functional reviews are conducted on the process elements of the EWBS. Functional reviews include: development (systems engineering and integration), support (including disposal and deployment), training, test, and manufacturing. These reviews assess the process's status in satisfying related level-3 product element objectives and requirements, to surface support and integrative issues, and to assess the development maturity of required plans, related items of equipment, technical manuals, and procedures to carry out the life-cycle process. The assigned IPT review teams are supplemented by other disciplines as needed to carry out a complete review of process needs and to resolve functional issues. These reviews allow functional review team members to address issues and assess progress of the functional requirements to provide life-cycle support to level-2 and level-3 products and other level-2 process elements.

Interim System Review. Interim system reviews are held for each level-2 product. Normally such reviews are held after the level-3 subsystem reviews and level-2 functional reviews have been completed. The level-2 product IPT should meet to resolve system-level conflicts that might arise between teams and may not have been resolved by the subsystem or functional reviews. Another type of interim system review is held prior to level-3 subsystem reviews. These are called interim system interface reviews. The purpose is to ensure that external and internal functional and physical

interfaces have been identified and issues resolved prior to level-3 product item developments commence. The leaders of all level-3 product and level-2 process teams would be involved with such reviews.

Major Reviews. Major reviews are held for the level-1 product of the system. At a major review, all team leaders, with their key support staff, demonstrate to the government that the accomplishments and criteria for that major review have been met. Additionally, they address any appropriate major issues and concerns that could not be solved during an interim system review. When IPTs and incremental reviews are utilized, downscoping of major reviews in terms of attendees required, purpose, and scope is not only possible, but appropriate.

EWBS and WBS Comparison

The actual forms of a WBS structured under MIL-STD-881 and an engineering WBS structured after the primary functions of MIL-STD-499B are similar in that both present a hierarchical breakdown of the product. They both have a program WBS, and contract WBSs to guide their respective activities. Both also include some of the same functional support areas (support, training, test and systems engineering). Major differences are in the inclusion of data, spare parts, operational site activation and systems management in the 881 model.

The engineering WBS has data developed as a system element of each product. Therefore, data is not separately broken out as a level-2 element as it is in the 881 model. Also, spare parts are not developed separately, only procured separately. Thus, there is no need in an engineering WBS for a spare parts element. Another major difference is how the two deal with manufacturing. An engineering WBS may include manufacturing as a level-2 process element in each program or contract WBS. As discussed previously, adding this process to level-2 develops all manufacturing system elements (hardware, software, techniques, materials, etc.) concurrently with development of level-3 products to enable later fabrication and/or production of those products. The other integration, assembly, test and checkout activities of an 881 WBS are integrated into the development activities of products or other processes, rather than as a separately designated element at level 3. Additionally, systems engineering in the EWBS includes development functions found in the 881 systems engineering and systems management element (e.g., system effectiveness analyses, trade studies, data management, configuration management, interface management, risk management, requirements tracking, logistics support analyses, etc.) and integration of specialty inputs. These are systems engineering activities as defined by MIL-STD-499B. Another difference is that the support process element on the 2nd level of an engineering WBS includes not only development of support equipments for the level-2 and level-3 products, but also system element development for deployment/installation and disposal of those products. The deployment/installation function would include operational site activation, as needed. This would normally only be a concern for the PWBS. Site activation is usually a program level concern (3rd level of the PWBS support element) and not normally a CWBS product-related engineering concern.

Proposed Resolution

The differences in the previous paragraph should not be considered significant departures from the models presented in MIL-STD-881, especially in this computer age. The primary purpose of a program is to develop build and sustain a defense system for the military user. As such, it is imperative that a WBS be used that supports efficient and effective engineering. Thus, the WBS should match the work needed.

All work accomplished and resources consumed during engineering of a system is coded according to contractual requirements and a contractor's cost-tracking system. Using the power of computers, coded work can be reported in any format or classification needed to satisfy government cost reporting/tracking needs. Additionally, CLINS, CDRLS and budgets can be directly related to EWBS elements as easily as to 881 WBS elements. It is my recommendation that the acceptable WBS should be the one needed by engineering to accomplish the technical tasks of the contract. The financial management and cost performance reporting communities need to identify their needs, communicate those needs by cost categories, and allow the structure of the WBS to be dictated by engineering needs rather than cost reporting needs. All communities need to work together to define acceptable WBS dictionary task and cost descriptions for each contractual WBS element. Appropriate cost reporting documents should be established to define standard cost estimating and cost data reporting needs (rather than structure) so that consistent data can be reported by contractors and government development agencies.

In those cases where the EWBS fails to provide needed program level or procurement information, such as for spares, the missing elements should be added to the EWBS so that not only engineering needs are satisfied, but also business needs are satisfied.

Conclusion

The WBS is an important document for the business and engineering communities. Too long has the WBS been in ill repute in the engineering community. It is time to make the WBS useful to all communities involved in the acquisition of defense systems. This paper is intended to stimulate new interest in the WBS by the engineering community and to re-

solve the differences long separating WBS business and engineering users.

An axiom of this paper is that the technical effort should be accomplished according to an engineering WBS, not to a WBS built primarily to accomplish business purposes and satisfy MIL-STD-881. Therefore, it is recommended that the engineering WBS that satisfies the principles of concurrent engineering and provides for satisfying the primary functions of MIL-STD-499B be adopted as the common WBS to be used by all acquisition communities. The cost reporting WBS structures of MIL-STD-881 should be made flexible so cost reports are not dictated by WBS structure but by information needed. The essential concern should be that required work gets identified and accomplished, contract management needs are fulfilled, and costs are collected. With the age of computers, any type of cost data can be reported in any form desired.

The implementation guidelines for an efficient and effective WBS should be:

1. The WBS must depict all work required by the contract.

2. The WBS must include a breakdown of products and associated lifecycle processes to enable development, manufacturing, test, deployment/installation, support, training and disposal. (These are the primary functions defined in MIL-STD-499B.)

3. The proposed contractor organization and staffing must be compatible with the WBS. Under concurrent engineering, integrated product teams are a necessary condition. Assigning IPTs to a specific WBS provides a smart and efficient way to organize resources and accomplish technical reviews.

4. The WBS must provide the ability to obtain product costs by level of development models (e.g., prototype, brassboard or breadboard, simulation, test and individual application), limited rate initial production model or full production model.

This paper is intended to stimulate new interest in the WBS by the engineering community and to resolve the differences long separating WBS business and engineering users.

5. The WBS must provide the ability to extract progress measurement information (technical, cost and schedule) for status reporting.

6. The WBS must provide assistance for risk assessment, engineering change proposal evaluation, contract change evaluation, interface management, data management, and configuration control.

7. The WBS must provide a framework for preparing a statement of work, cost estimates and budgets, and relating data requirements, contract delivery items, and event-based scheduling.

The engineering work breakdown structure illustrated in this paper enables these implementation guidelines to be fulfilled.

Endnotes

1. The Air Force preparing agency for revising MIL-STD-499B has scheduled release of the For Approval version during the summer of 1993. This is to be all-Service standard on systems engineering.

2. The EWBS does not identify particular system element solutions of hardware, software, data, people, materials, facilities, services or techniques, but only major product and process identifiers. The specifications developed for the prime item products, or for products to accomplish the processes, provide descriptions regarding performance and external characteristics of system elements. Accompanying or later developed sketches, drawings, associated material lists, technical orders and other descriptive documents provide internal definitions of the system elements.

References

Albert, N. F., "MIL-STD-881B: Work Breakdown Structure Application," Briefing to Program Management Association National Conference, March 31, 1993.

DoDI 5000.2, "Defense Acquisition Management Policies and Procedures," Washington, D.C., February 23, 1991.

Griffin, L. D. & Griffin, L. M., AFSC/ASD/EN Memorandum MIL-STD-881B, Wright-Patterson AFB, Ohio, May 11, 1992.

HQAFMC White Paper (DRAFT), "Integrated Product Development," February 9, 1993.

Maher, W. N., "Cutting a Path to Quality Through Concurrent Teamwork," *Program Manager*, November-December 1992.

MIL-STD-499B (Draft), "Systems Engineering," AFSC/ASD/EN, Wright-Patterson AFB, Ohio, May 1992.

NASA, *MSFC Handbook for Preparation and Implementation of Work Breakdown Structure* (DRAFT), George C. Marshall Space Flight Center, Huntsville, Ala., May 1992.

Schultze-Gullett, D., "Integrated Product Development: An Overview," *APICS Aerospace & Defense Symposium Proceedings*, Washington, D.C., March 1993, pp. 110-111.

Shishko, R. & Chamberlain, R. G., *NASA Systems Engineering Handbook* (DRAFT), Washington, D.C., September 1992.

SPRUCE, DOPE, AND FORDISM: THE FLYING COFFINS

America Acquires an Air Arm, Wright Brothers through the Great War

Wilbur D. Jones, Jr.

Already obsolete by the summer of 1917, the Americans nonetheless were mass producing a version of the British DeHavilland-4 (DH-4) observation airplane. A product of "Fordism," the desire was to get something — anything — to the Western Front, and salvage the program and reputations. Wary aviators called it the "flying coffin."[1] This is the story of why it became that way.

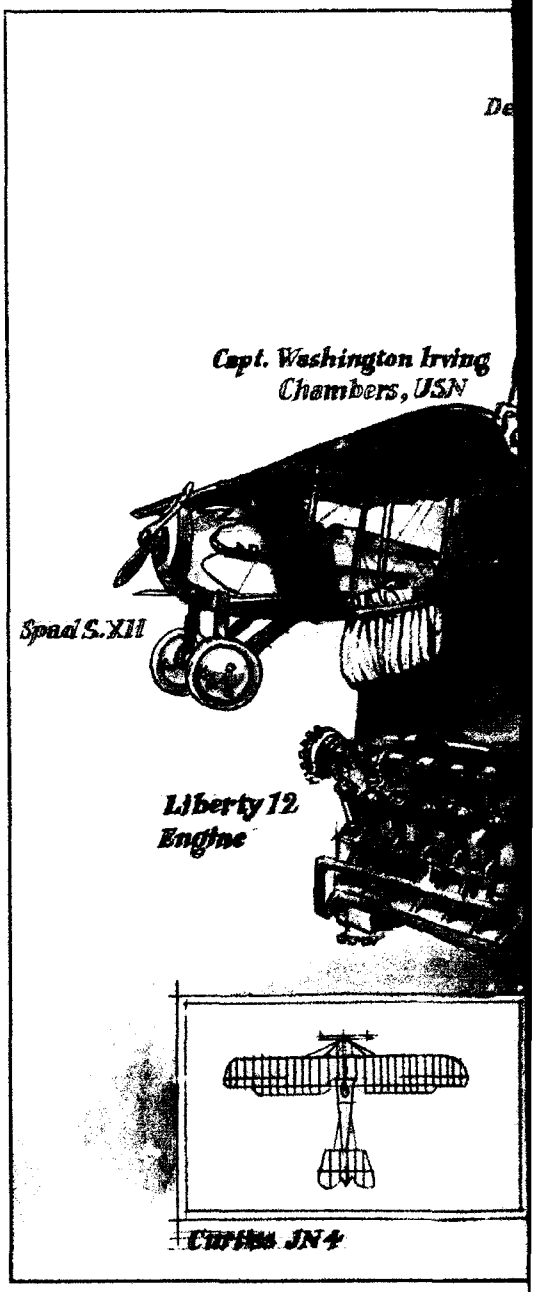
The day 17 December 1903 marked the dawn of a new age in science, when, at Kitty Hawk, North Carolina, Orville Wright flew the first power-driven manned aircraft. With his brother and partner Wilbur, the Wrights always contended they meant the airplane to contribute to international communications, trade and goodwill. But when they first attempted to sell an airplane, they sought the War Department as the buyer.

As the world approaches the 90th anniversary of the Wright Brothers' flight, *Program Manager* examines the skepticism and often disjointed early days of military aviation, and how America acquired an air arm for its part in the Great War of 1917-18.

[The reader is mindful of the first 25 or so years of aviation when aircraft construction was primitive compared to today. Principal components were wood, mostly spruce, for the airframe; cloth, mostly linen, for the skin; and dope, or varnish, for coating the fabric sheet, plus steel and wire.]

"The series of aeronautical experiments upon which we have been engaged for the past five years," Orville wrote in January 1905 marketing his flyer, "have ended in the production of a flying machine of a type fitted for practical use....The numerous flights...have made it quite certain that flying has been brought to a point where it can be made of great practical use in various ways, one of which is that of scouting and carrying messages in time of war."[2]

In October 1905, Orville wrote the Secretary of War offering "to furnish to the War Department practical flying machines suitable for scouting purposes."[3] The Department's Board of Ordnance and Fortification rejected the Wrights' advance, "until a machine is produced which by actual operation is shown to be able to produce horizontal flight and to carry an operator."[4] The Board had been stung



Professor Jones is the Director of the DSMC Press and DSMC Archivist and Historian. This account is taken from research on a book he is writing on the history of U.S. defense acquisition. To enliven the story, he recommends visiting the National Air and Space Museum, especially the World War I exhibit.

at the turn of the century by the failure of Dr. Samuel P. Langley, recipient of a secret $50,000 contract to develop a flying machine, to produce a suitable one. When the information became known, Congress and the press were extremely critical of "this so-called wastage of public funds" in America's first attempt to acquire military aviation.[1]

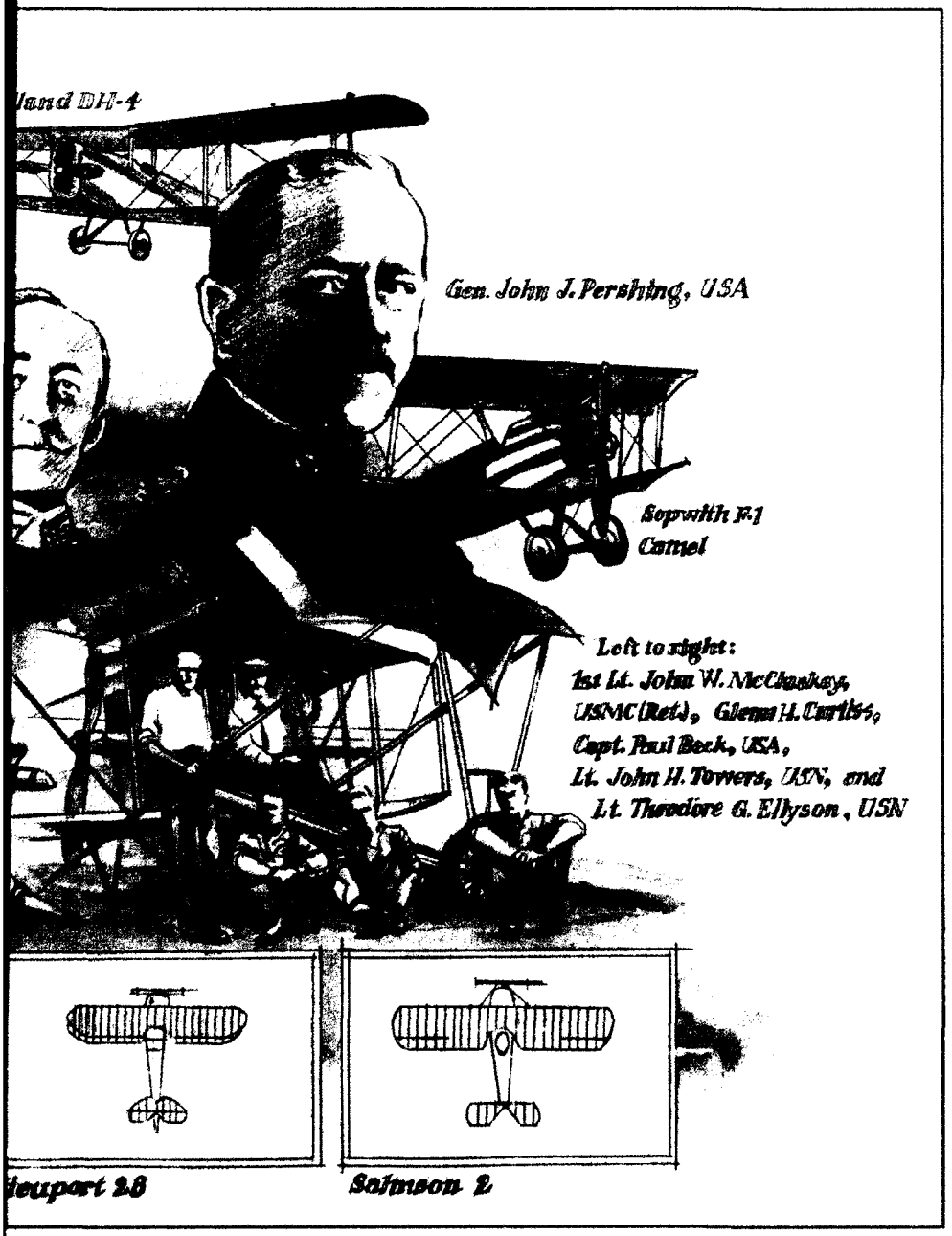
Undaunted, the Wrights continued. Orville wrote in June 1907, "We believe the principal purpose of a flyer at present is for military purposes, that the demand of commerce will not be great for some time." President Theodore Roosevelt agreed, and the Army took the initial step. In August 1907, the Signal Corps established its Aeronautical Division, and the Board reopened negotiations with the Wrights.

By December, the Board told the Signal Corps to solicit bids for the delivery of a heavier-than-air flying machine designed to carry two persons aloft for at least 60 minutes, with sufficient fuel for a flight of 125 miles, and with a speed of at least 40 miles per hour (mph). Military aviation's first request for procurement was underway. However, specifications did not include any operational requirements. The Wrights won the contract to build it, and when the airplane eventually was accepted on 2 August 1909, the Army had a new item of experimental hardware without a mission.

On 9 September 1908, Orville demonstrated his aircraft to a group of Army and Navy officers at Fort Myer, Virginia, and established a new record for flight duration of one hour, two minutes and 15 seconds. On a later test flight, with Orville at the controls, the machine crashed from 75 feet, injuring him and killing his army officer companion. Of the future of aircraft, the skeptical Signal Corps left the door open: "The military uses of a flying machine of any type will be only for purposes of observation and reconnaissance, or, as an offensive weapon, to drop explosives on the enemy." But for the latter role, it added, "a high speed aeroplane is hardly suitable."[1]

The Navy moved slower. The Acting Secretary disapproved an August 1909 Bureau of Equipment request for authority to advertise for construction of two flying machines, saying the airplane's development had not progressed sufficiently for its use by the Navy. Not until September 1910 did the Navy make reference to a provision for aviation in its organization, and a month later designated Captain Washington Irving Chambers, USN, as its focal point.

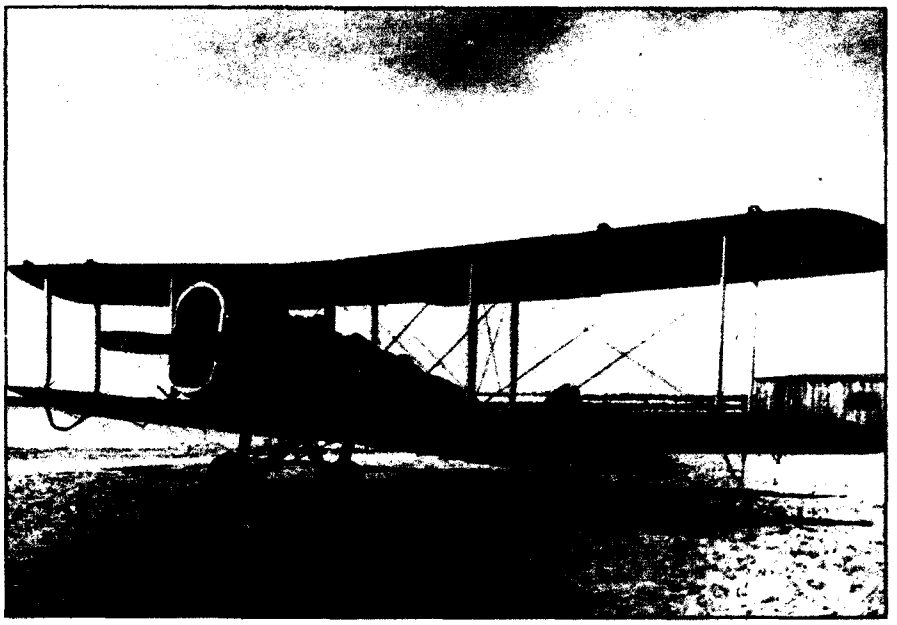
Congress was even more reticent about military aviation and injected itself into the controversy early and often, a trend which escalated for three decades until the prelude to U.S. involvement in World War II. In fact, the first congressional appropriations for aviation was not until 1911. By



All photos courtesy Naval Historical Center except as noted on pg. 1 and individual credits.

then, the Signal Corps air arm had grown to five aircraft, three balloons and six pilots. Lieutenant Henry H. Arnold, later the Army Air Force leader in World War II, had logged the most flying hours, 29.

The Signal Corps' Air Service, working with the old pusher-type airframes, had a "struggling and meager existence" until 1914, when Congress appropriated $250,000 for late model aircraft and equipment.[9] The Corps sent five officers to the Massachusetts Institute of Technology for a course in aeronautics, and when war flared in Europe in August 1914, they were the Air Service's only technically trained personnel.



DeHavilland DH-4 observation plane. A British design, the only aircraft mass produced in the United States during World War I, obsolete before production began.

But From the Deck of a Ship?

This is the most important achievement since wheels were put on land machines.

—Aircraft Builder Glenn H. Curtiss, witnessing the first catapult takeoff[10]

Meanwhile, the Navy entered the field on the back of Captain Chambers, practically alone in his zeal. A major breakthrough occurred in January 1911 when civilian Eugene Barton Ely of the Curtiss Aeroplane & Motor Company, flying a Curtiss pusher, landed on a special platform on the *USS Pennsylvania* at San Francisco, California. Chambers then asked the Wrights to fly a plane from the deck of a battleship. They declined, and he turned to Curtiss. On 10 November 1910, Ely took off from the bow of the *USS Birmingham* at Hampton Roads, Virginia, and landed 2-1/2 miles away across the Roads. The next month, Lieutenant Theodore G. Ellyson became the Navy's first aviator and was assigned for training to the Curtiss facility in San Diego, California.

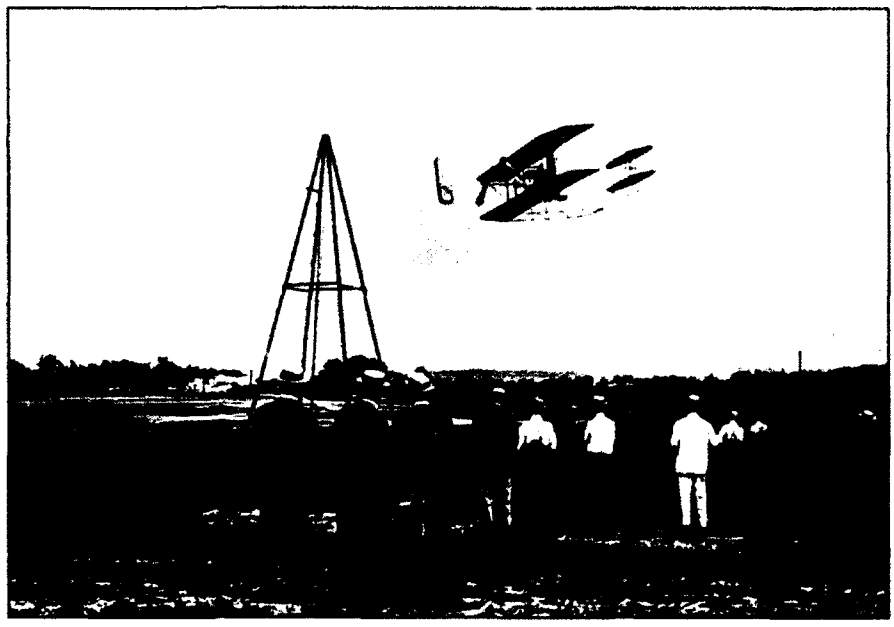
The "Flying Coffin," wrecked DH-4.

On July 1, 1911, Curtiss demonstrated the first aircraft built for the Navy, the A-1, by taking off and landing on a lake in Hammondsport, New York, a five-minute flight. It began the Service's long love affair with the float, or sea, plane. Ellyson soloed twice that same day, and later prescribed requirements for outfitting the naval aviator: a light helmet with detachable goggles or a visor, with covering for the ears and with holes for hearing the engine; leather coat lined with fur or wool; leather trousers; high rubber galoshes and gauntlets; and a life preserver.

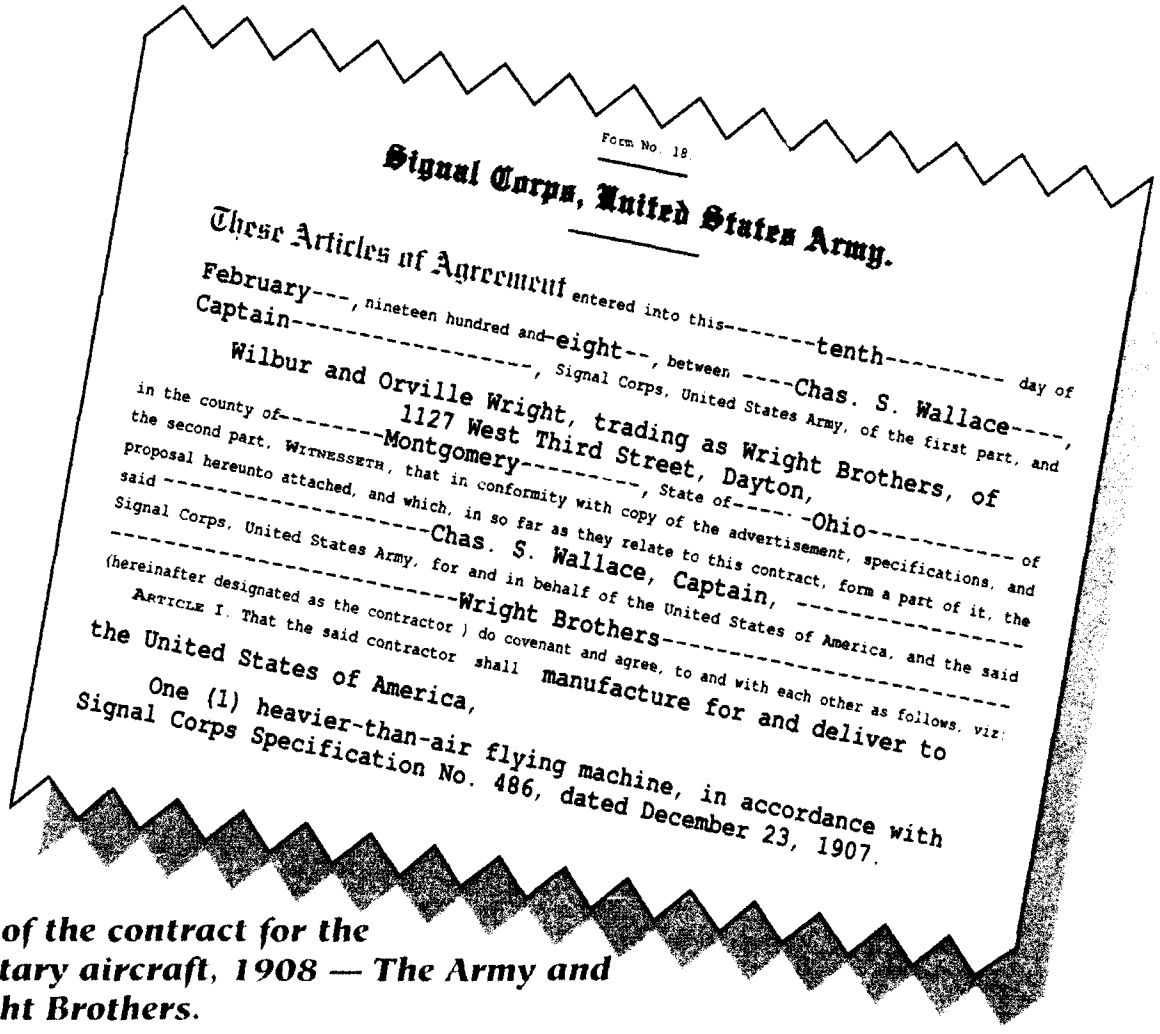
Chambers' successful effort spurred a 1911 congressional appropriation of $25,000. The Navy used the money to buy three machines, two Curtiss land planes and a Curtiss amphibian, built of wood, canvass and bamboo, which flew at 40 mph. The Wrights and Curtiss agreed to train a pilot and mechanic for each craft. In 1911, the first naval aviation activity was established near Annapolis, Maryland, and a permanent Navy Flying Corps

was created of naval and Marine Corps officers and men.

Chambers, in charge of naval aviation from September 1910 to December 1913, helped construct a wind tunnel at the Washington (District of Columbia) Navy Yard, accessible to private manufacturers, and worked to establish by law in 1915 a separate agency for scientific research in aeronautics for the organization eventually known as the National Advisory Committee for Aeronautics (NACA). The Navy Yard tested aircraft for propulsion, speed, controllability, stability, safety and buoyancy, and collected data on pontoons and float design, and on measuring the coefficients of air friction for varnished and unvarnished fabrics.



During flight tests, the Wright 1909 Military Flyer rounds a tower erected at Fort Myer, Virginia, July 1, 1909. **(Courtesy of National Archives.)**



Form No. 18.

Signal Corps, United States Army.

These Articles of Agreement entered into this------tenth------- day of February---, nineteen hundred and-eight--, between ----Chas. S. Wallace----, Captain----------, Signal Corps, United States Army, of the first part, and Wilbur and Orville Wright, trading as Wright Brothers, of 1127 West Third Street, Dayton, in the county of-------Montgomery--------, State of-----Ohio---------- of the second part, WITNESSETH, that in conformity with copy of the advertisement, specifications, and proposal hereunto attached, and which, in so far as they relate to this contract, form a part of it, the said ----------Chas. S. Wallace, Captain, ---------- Signal Corps, United States Army, for and in behalf of the United States of America, and the said ----------Wright Brothers---------- (hereinafter designated as the contractor) do covenant and agree, to and with each other as follows, viz:

ARTICLE I. That the said contractor shall manufacture for and deliver to the United States of America,

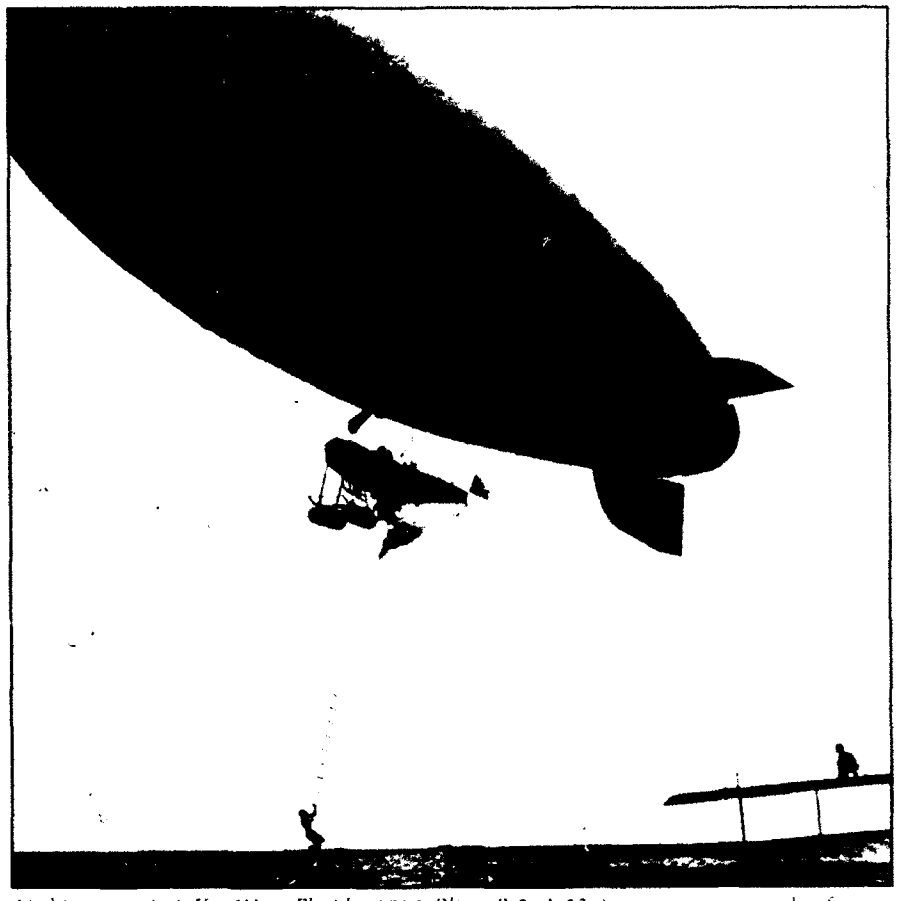
One (1) heavier-than-air flying machine, in accordance with Signal Corps Specification No. 486, dated December 23, 1907.

The core of the contract for the first military aircraft, 1908 — The Army and the Wright Brothers.

As an alternative to launching platforms, Chambers built an air catapult at the Washington Naval Gun Factory. On 12 November 1912, he accomplished the first successful catapult launching, the plane leaving the catapult at 35 mph in 2-1/2 seconds. The Navy Yard also constructed the first Navy-designed seaplane, the 82-A, a three-floater with two engines turning right or left to offset torque.

First Lieutenant Alfred A. Cunningham, USMC, was assigned as the first Marine Corps naval aviator on 11 May 1912, the date recognized as the birthday of Marine aviation.

The Navy finally established a formal Office of Naval Aeronautics under the Secretary in the Division of Operations, on 1 July, 1914. In 1915, Congress appropriated $1 million for naval aircraft and equipment, and in 1916, $3.5 million. The Navy ordered a dirigible, free balloon, floating dirigible shed, hydrogen plant for dirigibles, set of aeroplane hangers, aeroplane wrecking derrick, 73 aeronautic motors and 80 new aircraft, including 30 Curtiss N-9 floatplanes, variants of the "Jenny" training biplane. The Navy converted the abandoned navy yard at Pensacola, Florida, into an aeronautical station and assigned the armored cruiser *USS North Carolina* to aviation service. Experiments at Pensacola included testing the efficiency of gasolines and lube oils, types of floats for planes, instruments, clothing and special life preservers for aviators.



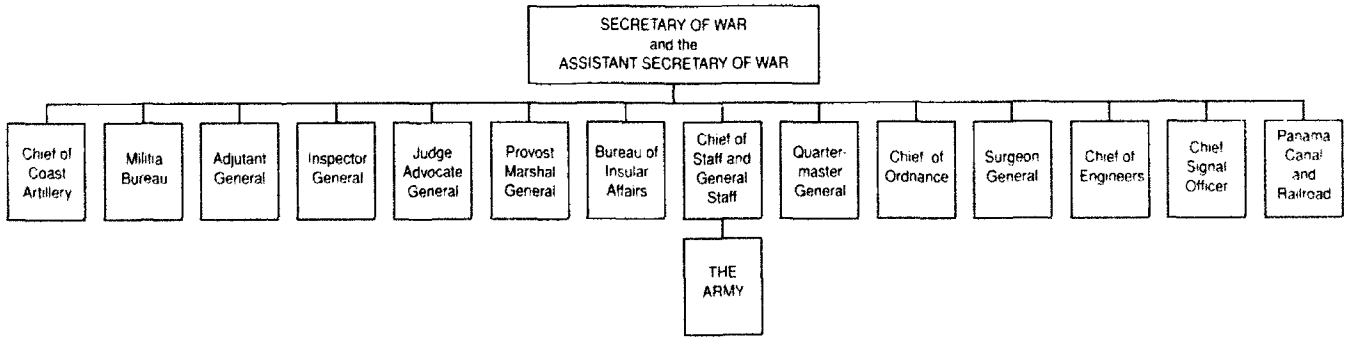
Airship rescue test, Key West, Florida, 1918. Blimp B-2 (A-236) removes crew member from a floating Curtiss N-9.

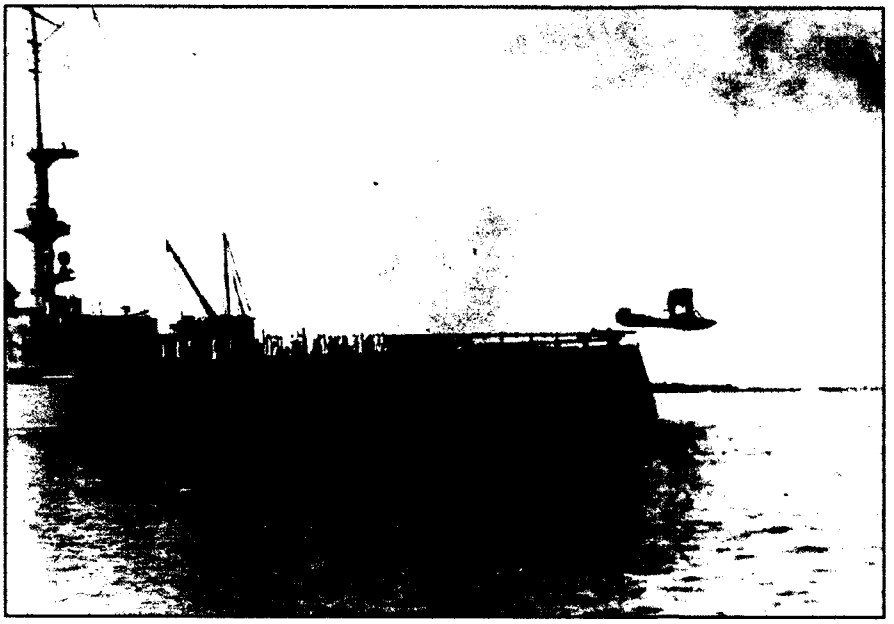
Making Up for Lost Time

> *The very limited flight performance of aircraft in 1912 had not demonstrated any military value other than reconnaissance.*
>
> **—Early enthusiasts, 1912**[11]

Army regulations in 1910 merely had noted that for purposes of reconnaissance (observation), "the dirigible balloon or flying machine is used as the commander directs."[12] Aviation doctrine and operating procedures were barely defined and roles and missions were debated. But in 1913, a fresh voice was heard, that of Army Captain William (Billy) Mitchell, an aviator who would become the most outspoken, and most persuasive proponent of military aviation in its history. Mitchell argued for an attack doctrine. "The offensive value of this thing [aircraft] has yet to be proved.

Organization of War Department in 1917





Curtiss AB-2 aircraft catapults from stern of ***USS North Carolina*** *during early catapult tests at Pensacola, Florida, November 1915. Note the use of after 10-inch gun barrel rigged as aircraft crane.* **(Courtesy of the National Archives.)**

It is being experimented with — bomb dropping and machines carrying guns...but there is nothing so far except in an experimental way."[13]

From 1903 to 1914, the American aircraft industry consisted of dispersed pioneer engineers operating small workshops building and testing a handful of customized airplanes mainly for wealthy sportsmen. Then came military and commercial interests — profits — and the larger companies grew. After the European conflict began, the Allies scoured the United States for suppliers. By 1917, at least 14 firms employing 10,000 were competing for U.S. and Allied contracts. Among the largest were Curtiss and the Wright-Martin Corporation.

When war erupted, Congress recognized the United States trailed in aeronautics. America had far fewer aircraft and pilots than six other major powers, including the Allies against Germany: Britain, France and Italy. In 1915, Congress established the NACA as an independent agency for the "scientific study of the NACA problems of flight with a view toward their practical solution."[14] Later, the issue of poor aviation readiness was evident in the support rendered for the April 1916 expedition of General John J. Pershing into Mexico against the Mexican outlaw, Pancho Villa. The situation had to be fixed.

Congress quickly passed the National Defense Act of 1916 and included a modest expansion of Signal Corps aviation matters, and funded even larger appropriations in 1917. The Army sent a commission to Europe, headed by Major R. C. Bolling, to study the types and capabilities of aircraft then deployed in combat, and advise the War Department on the planes, engines and equipment it should manufacture. Bolling, influenced by Mitchell, reported in July 1917, and the Department decided to produce the DH-4 as an observation plane and day bomber, the British Bristol and French Spad as fighters, and the Italian Caproni as a night bomber. Given the European technological progress, these machines would be obsolete before leaving U.S. factories.

A commentator noted, "We had lived to see other nations develop the invention into an industry and a science that were a closed book to our people. In the three years of warfare...the airplane had been forced through a whole generation of normal mechanical evolution. Of this progress we were aware only as nontechnical and distant observers."[15] Or, as another more bluntly put it, "With the low status of aviation in America, it is not surprising that we entered the war...almost as ignorant of the science of military aviation as any tribe of South Sea islanders."[16]

The United States joined the war in April 1917. The idea of conducting an air war against Germany caught the fancy of the American people, and propaganda posters proclaimed Kaiser Wilhelm's skies would be darkened soon with American planes.

FIGURE 1. DeHavilland-4, Standard Machine No. 31 U.S.-Produced; April 1918

Endurance at 6,500 ft., full throttle - 2 hrs., 13 mins.
Endurance at 6,500 ft., half throttle - 3 hrs., 3 mins.
Ceiling - 19,500 ft.
Climb to 10,000 ft. (loaded) - 14 mins.
Speed at ground level - 124.7 mph
Speed at 6,500 ft. - 120 mph
Speed at 10,000 ft. - 117 mph
Speed at 15,000 ft. - 113 mph
Weight, bare plane - 2,391 lbs.
Weight, loaded - 3,582 lbs.

Source: Crowell and Wilson, *The Armies of Industry*

Expectations were high, but then, wasn't America an industrial giant in its own right with something to prove?

But snarls developed immediately, and an ill-prepared nation stumbled through bureaucratic and organizational mayhem as the stalemated no-man's-land of France waited anxiously for the arrival of the doughboys.

Air Power: A Pig in a Poke?

> *Here is an unknown quantity - the use of flying machines....Did you ever buy a pig in a poke and take a chance on it? Sometimes it turns out very fortunately; sometimes with the loss of the money invested*
>
> **—House Minority Leader James R. Mann, July 1917**[17]

Military aeronautics, racing against obsolescence seeking state of the art, presented technical and funding problems requiring constant attention by government and industry. In 1917-18, where industry had a relatively free hand, technology evolved so fast that dealing with it was difficult even under controlled conditions. Mann believed, as did his congressional colleagues, the time had come when America could afford the money "in trying out the control of the air."[18] They touted aviation as America's opportunity to display its industrial prowess as "military power on the cheap."[19]

Source: **Vander Meulen**, *The Politics of Aircraft*

"The American Flag That Will Fly over Germany." This illustration, which appeared in the journal ***Flying****, August 1917, combines two powerful new ideas, air power and "Fordism," the system of assembly-line mass production that had recently and spectacularly emerged in America's auto plants. Similar cartoons were common in magazines and on the editorial pages of newspapers during 1917 as part of a national campaign directed by Howard Coffin.*

Government regulation came informally, for then the "aircraft industry meant military aircraft industry."[20] As a buyer, the congressional-military customer was a virtual monopsony. Congress imposed terms through contracting laws and appropriations to promote price competition and equal access to government work. Congress restricted interaction between the military and suppliers and ignored the views of industry. Manufacturers and the military collectively argued for negotiated development contracts from among a restricted list of manufacturers who could work together, limiting competition to production contracts. But Congress, desiring aeronautics to be a "democratic technology," said such policy violated values of political economy and heroism long associated with the aviation industry, and felt the collective position was a "prescription for monopoly — an 'Aircraft Trust.'"[21]

The times required the highest professional management and communications among everyone in the Services and industry, but fell short. Government financing of company expansion and cost-plus contracts made intervention inevitable, but Congress had organized the Services to avoid any required centralization.[22]

As America's war began, certain "experts" (progressive businessmen and engineers) convinced the public that massive air power was needed to defeat Germany, and they could man-

Curtiss JN-4H, the immortal "Jenny" military trainer.

age it. The line also persuaded Congress, who provided the experts wide latitude to act, making the period from July 1917 until the Armistice the only time Congress relented from directly controlling military aviation for the next 20 years. Eventually, what with the disappointing aircraft production numbers and embarrassing allegations of waste, Congress reasserted itself.

The experts believed mass production of aircraft, in the manner of Henry Ford's manufacture of automobiles, keyed successful production. "Fordism," it was dubbed. However, Fordism proved too inflexible for making wood, wire and fabric flying machines, because rapidly changing technology relegated mass-produced state of the art to a contradiction in terms.

Industrial engineer Howard Coffin was one of those experts. He and associates perceived that aircraft manufacture would soon rival "the horseless road vehicle," that aviation's future was commercial (the military application only temporary) and that the fear of aviation would deter future wars. Coffin became chairman of the Aircraft Production Board, and he and optimistic friends helped staff this and other wartime agencies and attempted to install Fordism production techniques.

Except for the notable experimental failed case of the DH-4 aircraft, Fordism was not really tested. Excited by Coffin, some firms expanded for mass production only to wait, and contracting delays continued long after Congress appropriated $640 million for aviation in 1917.

A Confessed and Notorious Failure — Almost

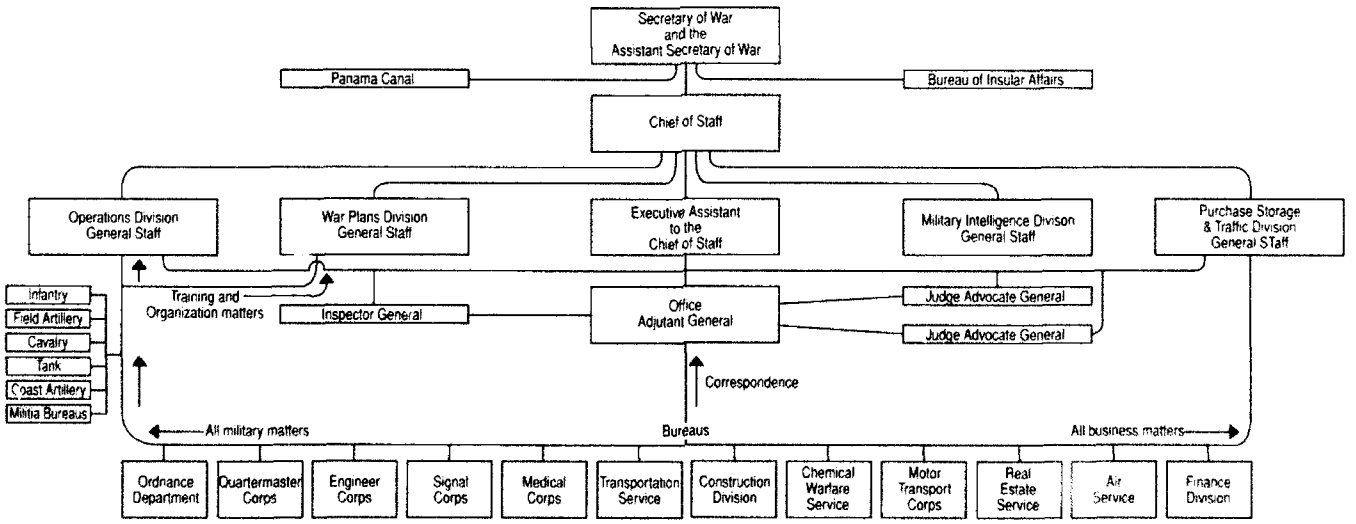
From April to December 1917, the War Department exercised little control over war production. One of two things was sure to happen: either the whole industrial program would go to smash and it would stand forth as a confessed and notorious failure, or it must reorganize.

—An observation, late 1917[3]

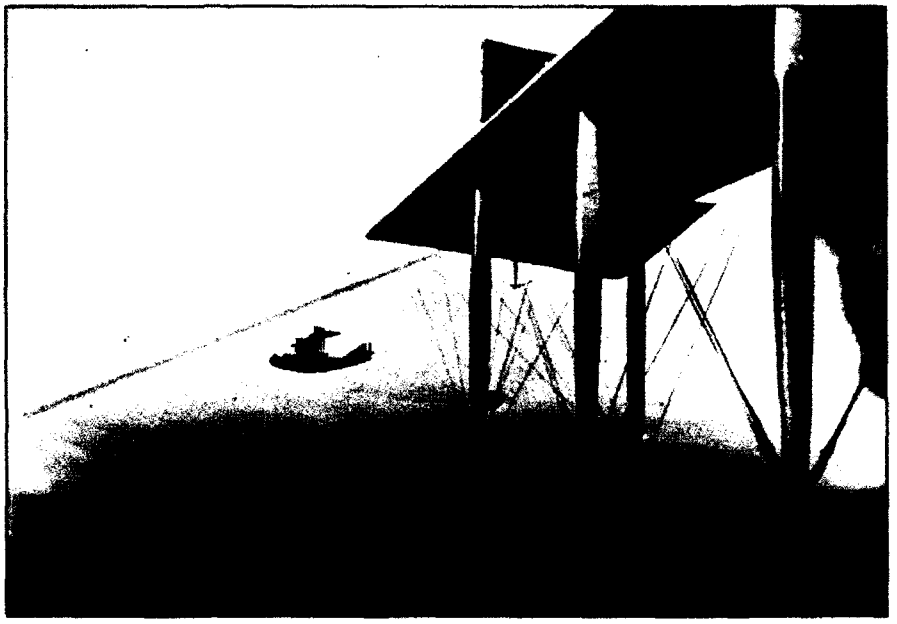
Reorganize it did, just in the nick of time, with a call to patriotism and the rallying cry of "over there!"

In April 1917, no phase of U.S. industrial might was expected to contribute as heavily as its aircraft industry. Yet, it was not ready, and no other U.S. industry could convert easily

Organization of War Department in 1918



to aircraft production. Americans for the most part could not build the modern airplanes being flown in Europe, nor had the engineering talent to design them. Prewar activities produced some trainers and engines for the Allies, but the antiquated ones on order in April were so behind technologically that the manufacturers sought release from contracts. The U.S. companies had to go to Europe to relearn principles of the discipline they had forged, and those men became the work force nucleus. After April, the Allies exposed U.S. engineers to their development and production techniques, and America tried catching up.



Curtiss H-16 patrol planes on reconnaissance flight out of Killingholm, England, November 1918.

In June, the Joint Army-Navy Technical Board recommended an immediate building program to the War and Navy Departments calling for 19,775 planes for American use, and 3,000 more to train Allies. Of the U.S. planes, 12,000 were for active service in France, 7,050 for training aviators, and 725 to remain for local defense. A previously cautious Congress appropriated $10.8 million in May, another $43.5 million in June, and a whopping $640 million in July.[24] The irony is that in the previous 12 months industry had built less than 800 aircraft, primarily trainers. Further irony was the requirement for an equivalent 80 planes for spare parts for every 100 ordered. Thus, the June program was for an equivalent of about 40,000 airframes.

The United States knew the summer of 1918 was the earliest it could equip an aircraft industry and reach high production. In the interim, the government ordered 5,875 French planes to be delivered by 1 July 1918, including Nieuport and Spad trainers, and Nieuport, Spad and Breguet service aircraft. In return, the United States gave the French the raw materials, including brass, lumber, machinery, steel, cable, bolts and other items.

The first production service aircraft was the British DH-4, built by Fisher Body and Dayton-Wright, a two-seater propelled by a 12-cylinder, U.S.-made Liberty engine. Before it could be manufactured, the plane had to be redesigned for U.S. machine guns, instruments and other accessories. The initial DH-4 was ready to fly 29 October 1917, and testing continued. The struggle to harmonize with the British version ended with production of machine No. 31 in April 1918. (See Figure 1 for its characteristics.) The U.S. DH-4s got to France in late 1917, obsolete on arrival, and were put together there after user demands required certain additional design changes. Peak production was 1,097 in October 1918.

One of the largest aircraft undertakings was the design and manufacture of the Liberty engine, America's distinctive and chief contribution to the air war, spurred by national pride. The United States possessed motor engineering talent as good as the European, better automotive manufacturing facilities, and desired to jump ahead of European technology rather than produce an existing engine destined for extinction once it hit France.

Exhaustively researched, the engine's original basic design essentially was never modified. The first 8-cylinder models were delivered in July 1917, six weeks after production lines opened. A good engine, the production program nevertheless sputtered and stalled, and tooling and ironing out design and production bugs in an assembly-line model took time. Packard Motor Company, a primary manufacturer, did not produce its first two production models until December 1917, and by then the 8-cylinder engines were obsolete, and a 12-cylinder one was required. That meant starting the design over again. From September 1917 to February 1918, Packard counted 1,022 production design changes. The first 12-cylinder unit was not tested until late August.

Other American producers included Ford Motor Company, General Motors Corporation, Lincoln Motor Company, Nordyke & Marmon, and Trego Motors Corporation. Daily U.S. production, centered in Detroit, Michigan, was greater than that of Britain and France combined. But the promised 4,000 U.S. units per month, of 100,993 engines ordered at $450 million, was but 1,110 by the end of May 1918. By then, the public was no longer under the illusion of darkening anybody's skies.

H-16 and F-5L seaplanes under construction in final assembly at Plant No. 2, Naval Aircraft Factory, Philadelphia, October 1918.

The Curtiss Company had been building 100 planes a month for the British by 1917 and drew the job of making trainers for American use, and by April 1918, had constructed 2,837 JN-4D "Jennys." Unfortunately, 1,200 defectively produced Jennys had to be destroyed at a $6 million loss. As for the obsolete DH-4, some people believed the Department's Bureau of Aircraft Production "felt it damn well had to get some kind of plane produced even if it wasn't a very good one."[25] Indeed, it wasn't capable of competing with advanced German models. And the United States manufactured no Spads or Capronis as intended.

In April 1917, Navy and Marine Corps aviation were too small and poorly equipped for war. Available were only 48 aviators and students, 54 aircraft (none capable of performing their required duties), and one operating air station. By late 1917, the Navy decided to use its aviation units of almost all float planes in antisubmarine warfare (ASW) against Germany, and began an ambitious program to build 1,700. The Goodyear Tire & Rubber Company built the first of their nonrigid blimps used for ASW patrol, the DN-1, in May. In November, the first Naval Aircraft Factory was constructed in Philadelphia and by the war's end had produced 183 twin-engine flying boats, many sent abroad. Expansion was swift but chaotic.

The Government's Aviation Interests Stabilize

The Army was a politicized hydra-headed holding company of supply bureaus with separate statutory authority, contracting powers, and congressional funding. Navy bureaus were far too comfortable in their semiautonomy to look with any but the most jaundiced eye at decreasing their authority.

—An indictment of bureaucracy, 1917[26]

Not until late August 1917 did the Signal Corps begin reorganizing for the tasks ahead. With cooperation from the Manufacturers' Aircraft Association (MAA) it solved a thorny question of property rights to research and development patents and cross-licensing. To avoid patent suits, companies relinquished their rights to the MAA and were paid a royalty for each plane delivered. To preserve competition each MAA member agreed to submit all patents to the MAA patent pool. Members were free to accept production contracts for planes designed by other members and were provided with complete technical data. More than 50 firms joined the pool by war's end.

The Aircraft Production Board (APB) was established in April 1917 to work with the Joint Army-Navy Technical Board to select and procure aircraft for full-scale production. Chaired by Coffin, APB membership included the Army and Navy air service commanders, chief of the Army Signal Corps and chief of the Navy's Bureau of Construction and Repair. Its influence was limited to suggestions and advice on design and production, planes to be built in various plants, allocation of priorities and contracting arrangements. However, the Services guarded their plans, avoided commitments until Congress funded them and generally ignored the APB. In October, the APB was enlarged and redesignated as the Aircraft Board, reporting to the Secretary of War. That Board became responsible for aircraft requirements and for placing contracts for aircraft and materiel production.

The President transferred Army aviation affairs from the Signal Corps to the new independent Air Service, located within the War Department's Division of Military Aeronautics and Bureau of Aircraft Production on 19 May 1918. "The Air Service, from its inception, has been the stormy petrel of the Army," wrote General Peyton C. March, Army Chief of Staff. "The World War made the Air Service.... The creation of the Air Service had to start from zero." But, he added, the number of planes America could put in the air was a "stupid exaggeration."[27]

Aircraft production, slow starting, was hardly any more incompetent than the overall national munitions program, but high hopes had generated a "doubly bitter" reaction.[28]

Early naval aviation pioneers man a Curtiss pusher biplane. Lieutenant Theodore G. Ellyson, USN, Naval Aviator No. 1, at controls, with Lieutenant John H. Towers, Naval Aviator No. 3. Circa 1911. **(Courtesy of the National Archives.)**

By December 1917, munitions production was near paralysis. Some factories were loaded with contracts far beyond their capacity to obtain materials, transportation, labor, or facilities, and some firms were so overloaded they could not deliver on time. Some areas faced a labor shortage, and others faced under- or unemployment of labor and facilities. Congestion contributed to area fuel and power shortages which nearly disrupted industry for weeks. Rumors, some true, quickly spread about shortages and serious failures in the government's supply systems. War Department bureaus, entrenched in self-endowed tradition and exclusivity, expanded and lost touch with the Secretary. Each became a sovereign potentate, and each bureau chief looked out for himself and let others fend for themselves.

Finally reorganizing in early 1918, War Department supply and procurement were concentrated within a single organization, the Division of Purchase, Storage and Traffic (DPST). Procurement matters were processed more satisfactorily, and pressure on suppliers increased. Had this arrangement been in place in April, the "most acute economic embarrassments" would not have occurred. "War industry would have proceeded with sanity and singleness of purpose instead of as a collection of competitors resembling traders battling in the wheat pit."[29] This organization persisted for 1-1/2 years after the Armistice to handle demobilization. The old independent bureau system had failed during the Spanish-American War, but no one applied the lessons learned when preparing for the Great War.

Heretofore, the Office of the Assistant Secretary of War, the number two, had been a political sinecure of considerable honor, but almost without practical responsibility. As a backwater post, it had collected minor functions unrelated to conducting war, such as administering the national cemeteries. However, Secretary Newton D. Baker seized the opportunity and gave the occupant "literally a blanket commission to rescue our war industry."[30]

In August 1918, the Secretary named John D. Ryan, head of the Department's Bureau of Aircraft Production, as Assistant Secretary and Director of the Air Service, Director of Munitions and his industrial advisor. Through the DPST the Assistant Secretary gained control of industry. General March remained the Secretary's military advisor and the General Staff remained purely a military body with perfunctory procurement chores. Theoretically, all Army aviation affairs now were under one head for the remainder of the war. Subsequently, the War Department improved coordination with the Navy Department, War Industries Board, Shipping Board and other agencies.

Because their extravagant program goals could not be met, in 1918 the Aircraft Board and appropriate War Department and Signal Corps offices became the targets of strong criticism and congressional investigations. Thus, the Air Service became the "storm center" of all attacks on the War Department's conduct of the war. President Woodrow Wilson quieted the investigators by naming the esteemed Charles Evans Hughes as a special investigator of aircraft production, under the Attorney General, and other investigators left the rest to Hughes. His report of October 1918 found obvious things to criticize, but no wholesale misuse of public funds as charged.

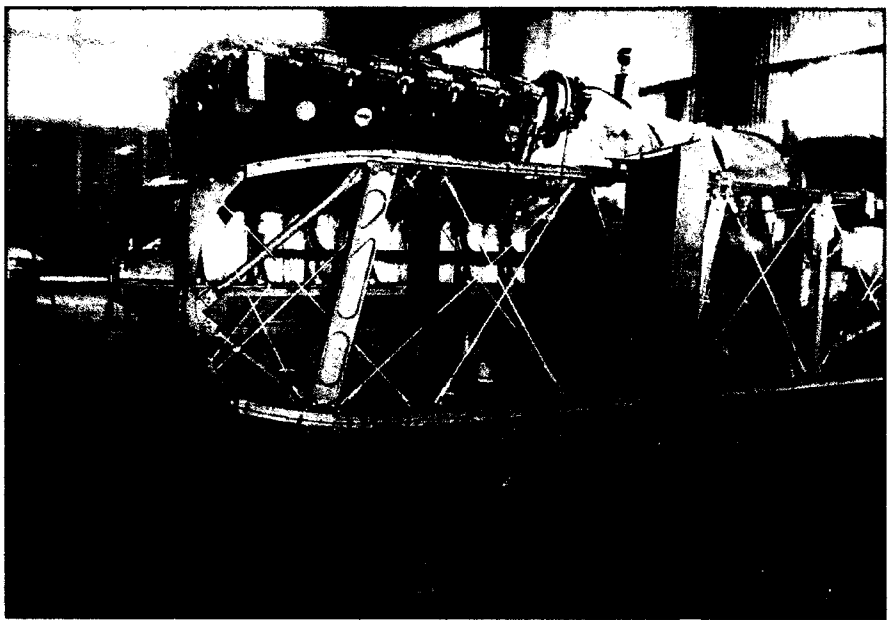
The Epitome of User Feedback

In order to hold the supremacy of the air on the Western Front it is absolutely necessary that the United States keep France, England and Italy fully provided with raw, semifinished and finished aircraft materials even at the expense of temporarily delaying the United States Army and Navy Air Program.

—Pershing to March, 12 April 1918[31]

We will meet your wishes, but wish to inconvenience our factories as little as may be, in order that the ultimate output may not be seriously jeopardized.

—March back to Pershing[32]



The Liberty 12 engine and radiator in an aircraft under construction, 1918.

General Pershing arrived in France on 13 June 1917 as commander of the American Expeditionary Force (AEF), America's contribution to the European front, and named Mitchell as his Chief of Air Service. In August, Pershing requested and was granted authority to determine the AEF aircraft requirements, and the authority of the Aircraft Board speedily deteriorated.

Pershing's constantly changing aircraft requests exacerbated the tough development and production conditions at home in the early weeks of the war. As one observer noted, the War Department "never knew from day to day where he stood. As soon as we got going in the construction of a type which he had stated was necessary, a cable would come in from him, saying that he did not want that type and asking for something else. This would involve a redesign of the plane, changes in the factories making them, and delay all along the line." The manufacturers simply "threw up their hands." Ryan took "the bull by the horns" and told manufacturers no more changes would be authorized, and only then did they know they could proceed safely.[33]

The first American air unit to arrive in France was the 1st Aero Squadron, on 3 September 1917. After extensive training in British Salmson observation aircraft, it was assigned into combat 8 April 1918. The Yanks were in the air only seven months. By the time of the Armistice, 11 November 1918, the United States had 45 Army Air Service squadrons in France. Twelve were equipped with U.S.-built DH-4s and the others flew planes bought from the British and French: Sopwith Camels, Salmsons, Spads and Breguets. Combat statistics were adequately impressive. The Americans assigned 740 aircraft and 767 pilots to the AEF, shot down 781 enemy aircraft and 73 observation balloons, and dropped 275,000 pounds of explosives in 150 bombing raids. Losses were 289 planes and 48 balloons and most of their aviators.

Naval aviation flew more than three million nautical miles damaging a dozen German submarines. Long-distance flying boats were its major contribution to the war effort, all traceable to Curtiss' work a few years before and progressing from the HS-1 to the H-16 and British F5L. The wartime Curtiss NC type in 1919 would become the first aircraft to fly the Atlantic. By the war's end naval aviators were operating from 27 European bases, 12 in the United States and several others in the Atlantic.

Educating the Lumber Industry

> *Just as the airplane...had been saved by the prompt action of the Signal Corps in organizing and training the spruce industry, so again the uninterrupted expansion of the Allied aviation program was made possible by the decision to produce cotton fabric and by prompt action in cornering the supply.*
>
> **—The value of raw materials**[34]

Because lumber, principally spruce but also fir, was the basic aircraft material, the War Department enlisted help from the U.S. Forest Service and Wisconsin Forest Products Laboratory to educate the lumber industry in how to saw and dry the lumber. The Signal Corps established an office to search for spruce in the Northwest in an industry in "chaotic condition."[35] (The Allies' desire for the wood resulted in two-thirds of the 175 million lumber feet going abroad.) Labor union unrest and detrimental propaganda were muted through formation of a society called the Loyal Legion of Loggers and Lumbermen. Producers and operators gave the Signal Corps all power to decide labor disputes, and eventually the government provided financial assistance for equipment installation, standardized log sizes, and fixed a price that stabilized the market.

Even though most aircraft materials were available in America, shortages became apparent immediately, including linen, the principal wing fabric. Industry developed a superior substitute fabric of long-fibered cotton, and a substitute for dope, the substance used to paint the fabric. The government believed castor oil to be the only fit lubricant for engines and

had to send to Java for the beans. Eventually, castor beans were planted and mineral oil substitutes developed. Mahogany used for early propellers was partially replaced by cherry, walnut and oak. In all, some $80 million were spent developing new sources of spruce, dope, fabric and castor oil.

As aircraft construction was refined, a corresponding improvement in accessories took place. America manufactured an oxygen mask equipped with telephone connections which enabled a flyer to endure rarefied air without losing speaking contact with his companions; the military parachute, used principally for escaping balloons; electric-heated clothing; long-focused cameras; and the wireless telephone.

United States military and naval aviation, hampered by a paced reaction to evolving technology and management fits and starts, at the end had begun to grow modern with the age. In certain respects, but not all, it caught up. With no time for a second wind, even more turbulence lay ahead in the interwar years.

Epilogue

During the Great War, Army aviation alone cost $720 million, for which the Army received approximately 19,000 aircraft and 41,000 engines at an average cost of $6,000 apiece. Because of the rapid deterioration and obsolescence of early aircraft, the military value for funds expended was questionable. Despite investigations which muted outcries, "the great post-war bonfires in Europe," an observer wrote, "in which thousands of surplus aircraft were disposed of...were widely viewed as confirmation that the American people had been systematically swindled." Only in the aircraft industry, where engineers, scientists and technological change were so prominent, and where government-industry relations so necessary, were wartime experiments in political economic reform such a failure.[36] "It left a bad aftertaste for a long time."[37]

In his memoirs, Mitchell said he was sorry the Armistice had come before aviation had proved itself. To his dismay, discounting the American attack successes, Army regulations in 1919 continued to call for the Air Service to support the Infantry, "the chief combatant," as an information gatherer.

Many naval aviators urged making the flying boat the principal platform for taking air power afloat. Others argued that aircraft should fly from combatant ships. Some urged concentrating on airships. Post-war programs developing each continued, but within months of the Great War's conclusion, the Navy decided to convert a collier to a carrier, and another new age dawned.

Endnotes

1. Vander Meulen, p. 39.
2. Futrell, p. 8.
3. *Ibid.*
4. *Ibid.*
5. *Ibid.*
6. *Ibid.*
7. The first military aircraft procurement action became an icon for simplicity and sometimes wishfully is cited by "reformists" seeking the acquisition process.
8. Futrell, p. 8.
9. Crowell and Wilson, *The Armies of Industry*, pp. 1, 328.
10. Arpee, p. 75.
11. Futrell, p. 9.
12. *Ibid.*
13. *Ibid.*
14. Futrell, p. 10.
15. Crowell and Wilson, *The Armies of Industry*, pp. 1, 325.
16. Crowell and Wilson, *How America Went to War*, XV.
17. Vander Meulen, p. 14.
18. *Ibid.*
19. *Ibid.*
20. Vander Meulen, p. 5.
21. Vander Meulen, p. 6.
22. By law, advance payments and cost-plus contracts were prohibited until late summer 1917.
23. Crowell and Wilson, *The Armies of Industry*, pp. 1, 6.
24. The $640 million was the largest appropriation ever made for one specific purpose and sailed through Congress in a little more than a week.
25. Fredericks, p. 177.
26. Vander Meulen, p. 24.
27. March, pp. 198-99.
28. Fredericks, p. 178.
29. March, p. 200.
30. Crowell and Wilson, *The Armies of Industry*, pp. 1, 11.
31. John J. Pershing to Peyton C. March, 12 April 1918, quoted in *March*, p. 204.
32. March to Pershing, quoted in *March*, p. 205.
33. *March*, p. 207.
34. Crowell and Wilson, *The Armies of Industry*, pp. 1, 339.
35. Crowell and Wilson, *The Armies of Industry*, pp. 1, 336.
36. Vander Meulen, p. 40.
37. Vander Meulen, p. 39.

Bibliography

Edward Arpee, *Frigates to Flat-Tops* (Lake Forest, IL: 1953).

Benedict Crowell and Robert Forrest Wilson, *How America Went to War: The Giant Hand: Our Mobilization and Control of Industry and Natural Resources, 1917-18* (New Haven: Yale University Press, 1921).

Benedict Crowell and Robert Forrest Wilson, *The Armies of Industry: Our Nation's Manufacture of Munitions for a World in Arms, 1917-1918*, Volume 1 (New Haven: Yale University Press, 1921).

Harvey A. DeWeerd, *President Wilson Fights His War: World War I and the American Intervention* (New York: The Macmillan Co., 1968).

Pierce G. Fredericks, *The Great Adventure: America in the First World War* (New York: E. P. Dutton & Co., 1960).

Robert Frank Futrell, *Ideas, Concepts, Doctrine: A History of Basic Thinking in the United States Air Force*,

1906-1964 (Maxwell Air Force Base: Air University, 1971).
Harrison S. Kerrick, *Military and Naval America* (New York: Doubleday, Page & Co., 1916).
Peyton C. March, *The Nation at War* (New York: Doubleday, Moran & Co., 1932).
Peter B. Mersky, *U.S. Marine Corps Aviation: 1912 to the Present* (Annapolis, MD: The Nautical & Aviation Publishing Company of America, 1983).
United States Naval Aviation, 1910-1980 (Washington: Deputy Chief of Naval Operations (Air Warfare), and Commander Naval Air Systems Command, 1981).
Jacob A. Vander Meulen, *The Politics of Aircraft: Building an American Military Industry* (Manhattan: University Press of Kansas, 1991).

A STATUS REPORT ON DSMC BOOKS SOLD BY GPO

The Defense Systems Management College (DSMC) is in the process of updating several of its popular guidebooks. The process is slow due, in part, to changes in the world that impact on the way we manage the business of acquiring weapon systems.

Because the updates are in process, the U.S. Government Printing Office (GPO) decided not to reprint some titles. The end result is that several books are temporarily unavailable at GPO book stores.

Books currently available at GPO bookstores across the country are listed below along with GPO stock numbers and prices:

Commercial Practices for Defense Acquisition (1992)
008-020-01273-4 ..... $8.50

Congressional Involvement and Relations (1992)
008-020-01281-5 ..... $7.00

Defense Manufacturing Management (1989)
008-020-01169-0 ..... $17.00

Integrating Industrial Preparedness Into the Acquisition Process (1989)
008-020-01165-7 ..... $10.00

Introduction to Defense Acquisition Management (1993)
008-020-01297-1 ..... $2.25

Managing Quality and Productivity in Aerospace and Defense (1989)
008-020-01179-7 ..... $15.00

Risk Management Concepts and Guidance (1989)
008-020-01164-9 ..... $13.00

Scheduling Guide for Program Managers (1990)
008-020-01196-7 ..... $4.00

Skill in Communications (1990)
008-020-01218-1 ..... $4.50

Standards and Trade in the 1990s (1993)
008-020-01294-7 ..... $13.00

Streamlining Def Acq Laws Executive Summary:Report of the DOD Acquisition Law Advisory Panel (1993)
008-020-01298-0 ..... $6.50

Subcontracting Management Handbook (1988)
008-020-01140-1 ..... $8.00

The Program Manager's Notebook (1992)
008-020-01289-1 ..... $31.00

The College's popular *Systems Engineering Management Guide, Test and Evaluation Guide, Integrated Logistics Support Guide, Glossary of Acquisition Acronyms and Terms* and *Mission Critical Computer Resources Management Guide* will be sold by GPO when updates are published. Washington, D.C., and 21 other major cities have GPO bookstores. In addition, there is a retail sales outlet in Laurel, Md. If the store nearest you cannot get the book you want, call central ordering at (202)783-3238. Call DSMC numbers (703) 805-2892 and 805-2743 for information on how to obtain DSMC publications not sold by GPO. (See page 56 for GPO Bookstores.) **Robert Ball**

HELPING OUR CUSTOMERS

A Professional Acquisition Corps

Colonel Andrew A. Zaleski II, USAF
James S. Sheldon

The 1990 Defense Acquisition Workforce Improvement Act (DAWIA) triggered a fundamental change at the Defense Systems Management College (DSMC). This law empowered the Department of Defense (DOD) to establish a professional acquisition corps for military and civilians, and to implement an ambitious and comprehensive plan to train this corps to manage the defense acquisition process in an effective and efficient manner. The keystone regulations governing this plan are DoDD 5000.52 and its implementing manual, DoD 5000.52M. One of the central propositions of DAWIA is the establishment of the Defense Acquisition University (DAU). The DAU is a consortium of 16 defense education institutions including DSMC whose mission is to coordinate acquisition training and education activities of DOD components.

...a professional acquisition corps for military and civilians, and to implement an ambitious and comprehensive plan to train this corps to manage the defense acquisition process in an effective and efficient manner.

FIGURE 1. Twelve Acquisition Career Fields

Career Field	Total
Program Management	8,172
Contracting	21,080
Industrial Property Management	643
Purchasing & Procurement Assistant	6,514
Manufacturing & Production	4,357
Quality Assurance	8,768
Business, Cost Est & Financial Management	3,304
Logistics	8,932
Communications - Computer Systems	2,217
System Planning, Research, Devel. & Eng	25,559
Test & Evaluation	5,752
Auditing	4,643
Other / Unknown / Not Coded	14,865
Total	114,816

Acquisition Career Fields/ Membership

The DoD 5000.52M defined 12 acquisition career fields with three certification levels within each (I, II & III), and established experience, education and training requirements necessary to achieve certification at each level. Each career field has an Office of the Secretary of Defense (OSD) Functional Board comprising key management: Users of that functional area — OSD and the Services. The functional boards determine the training, education and experience needed to obtain certification at each level. The 12 acquisition career fields and their membership are shown at Figure 1 (as of April 8, '93). This data, of course, continue to be refined as the Services survey and define their work forces.

Mandatory Courses

The 1993 DAU Catalog lists 59 mandatory courses identified by the functional boards to satisfy DAWIA training requirements. This number is in flux as DAU and the functional boards review the requirement and existing courses. Since 1991, the number of DAU-mandatory courses offered by DSMC rose from 3 to 11 in 1993, with 3 more to be added in

Colonel Zaleski is Executive Director and Mr. Sheldon is Deputy Director of the DSMC Executive and Short Courses Division.

***Program Manager* intends to inform readers of new trends in the acquisition academic world. Items concerning the DSMC Program Management Course and the Executive and Short Courses will be published in the column "DSMC Academic Environment."**

FY '94. The DSMC now has courses that satisfy DAU mandatory training requirements for 9 of the 12 career fields.

Growth in Mandatory Course Offerings

The dynamics of the combination of this large defense acquisition workforce requirement together with the growth in the number of mandatory courses resulted in an overwhelming training demand from our customers (the Services and the DOD organizations and agencies). The Services' acquisition work force is now managed by Directors of Acquisition Career Management (DACM), one for each Service and one for the DOD organizations/agencies. One of the major responsibilities of the DACMs is to identify membership and training requirements by career path and certification level for their respective Service. The 110,000+ figure in Figure 1 represents a substantial challenge to the acquisition education community.

Although the 20-week Program Management Course (PMC) remains DSMC's flagship mandatory course and our most significant product, 90 percent of the growth in training requirements was in 11 mandatory short courses ranging from 1 to 4 weeks in length. The DSMC made a prodigious effort to respond to our customers in the traditional mode of education. From 1992 to 1994, we have doubled the output of our mandatory course section weeks. However, we have just about maximized our capacity given manpower and facility constraints and conventional education practices. This forced us to look for new ways to expand student throughput while maintaining traditional DSMC course quality.

Multiplier Methods

To that end, DSMC launched a series of "multiplier methods" to generate the maximum capability out of available resources, using technology and innovation. During the next year, DSMC will publish a series of articles in this publication on these multiplier methods. This article gives a brief introduction to them.

Adjunct Faculty

Interested acquisition commands or educational institutions nominate qualified individuals to become adjunct faculty for specific mandatory courses. After training and certification, these faculty members can provide mandatory course offerings at the originating command. Requirements are qualified nominees and willingness of the host command to dedicate the qualified personnel for a substantial number of course offerings. Currently, Patuxent Naval Air Station has an adjunct professor who will form a team to execute 12 TEMC offerings in FY '94. Other agencies are working with us to get their personnel qualified.

Certified Course Offerers

There are 15 other educational institutions in the consortium comprising the Defense Acquisition University. These institutions have substantial expertise in the various acquisition functional areas that require mandatory training under DAWIA and DoD 5000.52M. As these institutions participate in the adjunct faculty program (above), they will come under consideration to become certified offerers, capable of teaching and maintaining a substantial academic schedule of mandatory courses at their locations or at user-sites.

Correspondence Courses

Although not our primary mode of instruction, this is a promising method to reach a large number of students for selected courses (quantitative, knowledge-based). The DSMC has one correspondence course in operation — Contractor Performance Measurement Individual Self-paced Course. An additional course, Systems Acquisition Funds Management ISP, will be piloted in 2Q FY '94 and fully available by FY '95.

Equivalency Exams

We are investigating using an exam as an alternative to attending a mandatory course for individuals not needing specified mandatory training by virtue of their work experience, education and/or personnel knowledge. This method enables an individual, based on prescreened acquisition experience and training, to take an equivalency exam at his/her location and, if passed, gain accreditation in lieu of attending a mandatory course. Intermediate Systems Acquisition Course (ISAC), formerly ABC, is the prototype. Pilot exam will be available by 2Q FY '94.

Satellite Education

The DSMC is establishing a satellite education network, initially among our four regions: (Hanscom AFB, Mass.; Los Angeles Space Missile Division, Calif.; Redstone Arsenal, Ala.; and, Army Aviation Command, St. Louis, Mo.). In FY '94, we will pilot a satellite offering of the Fundamentals of Systems Acquisition Management (FSAM) course at Ft. Belvoir and the four regions. Other courses will be added in FY '95. Expansion of the network to other remote sites will be determined at that time.

Tutored Video Instruction (TVI)

The DSMC is investigating using video tapes of instruction, coupled with a facilitator, as a method to teach all or part of a course. This method has a long and successful history in several prestigious universities. At this time, we are focusing on using TVI to execute selected parts of courses in order to reduce travel costs for regional offerings. We also are experimenting with using tape for one complete course, but have made no decisions on whether this is an acceptable method of production.

ACQUISITION LAW PANEL REPORTS TO CONGRESS

Colonel Kenneth Allard, USA

The DOD Acquisition Law Advisory Panel concluded its formal proceedings with the transmission of a massive, 1,800-page report to the defense committees of the Congress on January 14, 1993. Formed under the sponsorship of the Defense Systems Management College in August 1991, the 13-member-Panel—known as the Section 800 Panel because of the law requiring its formation—had a congressional mandate to review the "acquisition laws applicable to the DOD with a view toward streamlining the defense acquisition process."[1]

The Panel reviewed more than 600 laws that it determined were relevant to this charter, eventually presenting specific recommendations for the amendment, repeal, deletion or consolidation of 298 of those statutes. Each of those recommendations was supported by a legislative history documenting the original intent of Congress in passing the law, an analysis of its practical effects, and proposed statutory language. This level of detail, applied across the full spectrum of laws affecting defense procurement, clearly distinguishes the work of the Section 800 Panel from others which have examined these issues.

Colonel Allard is the author of ***Command, Control and the Common Defense*** *(Yale, 1990) and is an Adjunct Professor in the National Securities Studies Program at Georgetown University. Prior to his current assignment as Dean of Students at the National War College, he served as Deputy Executive Secretary of the Acquisition Law Task Force.*

Initial Reactions

The report appears uniquely well-timed to take advantage of sweeping changes occurring throughout the government. In a February speech on technology initiatives, President Clinton criticized the "growing mass of procurement laws and regulations" and pledged that it would be a priority of his administration to reform government procurement policy. He also stated that this effort would begin with a review of the Section 800 Panel's recommendations.[2] In his Senate confirmation statement, Deputy Secretary of Defense William J. Perry stressed the need for a streamlined defense acquisition system in order to "reduce the overhead burden defense companies must carry" and to promote the integration of "our defense industrial base with our national industrial base."

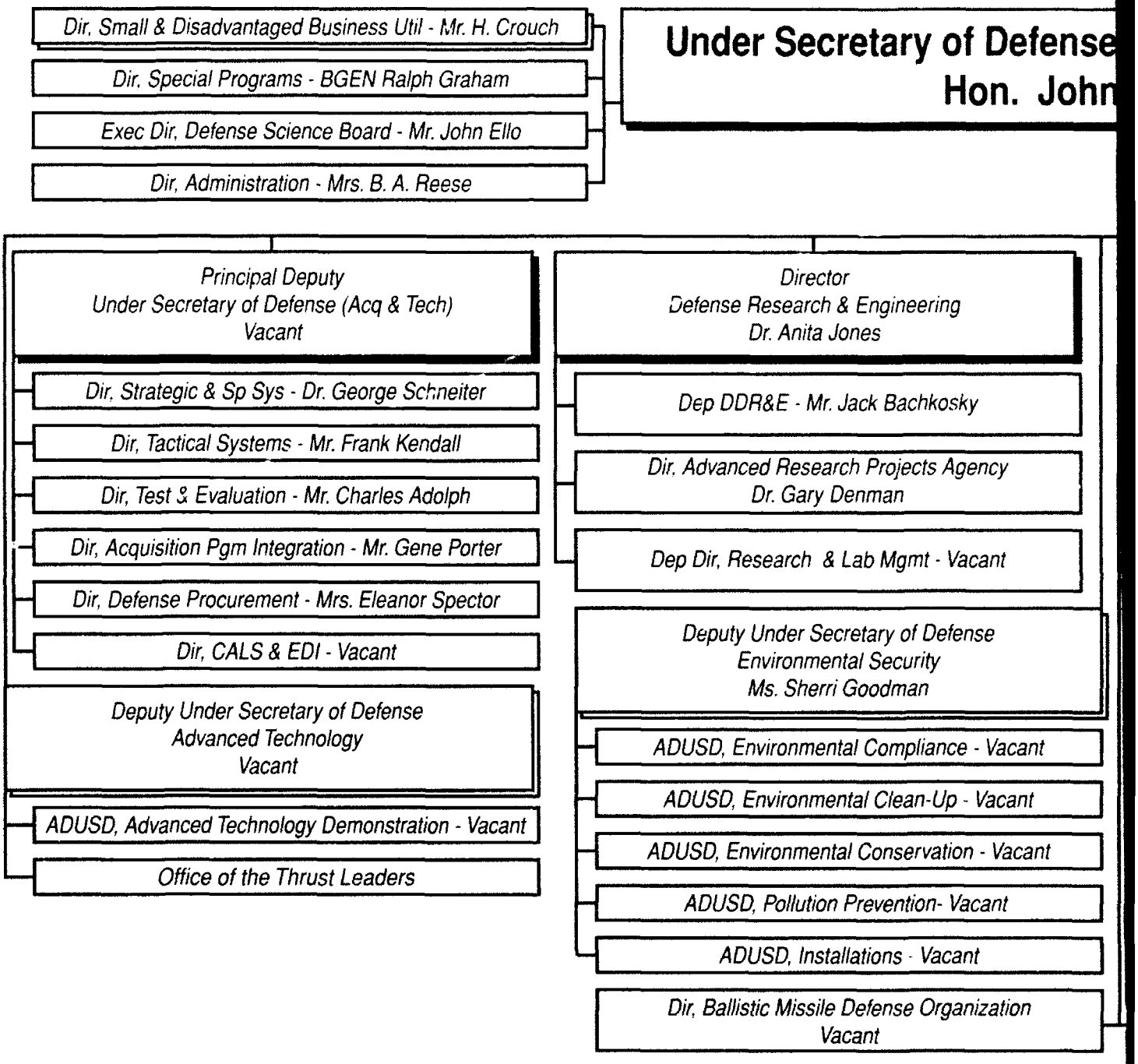
Senator Sam Nunn, (D-Ga.), Chairman Senate Armed Services Committee.

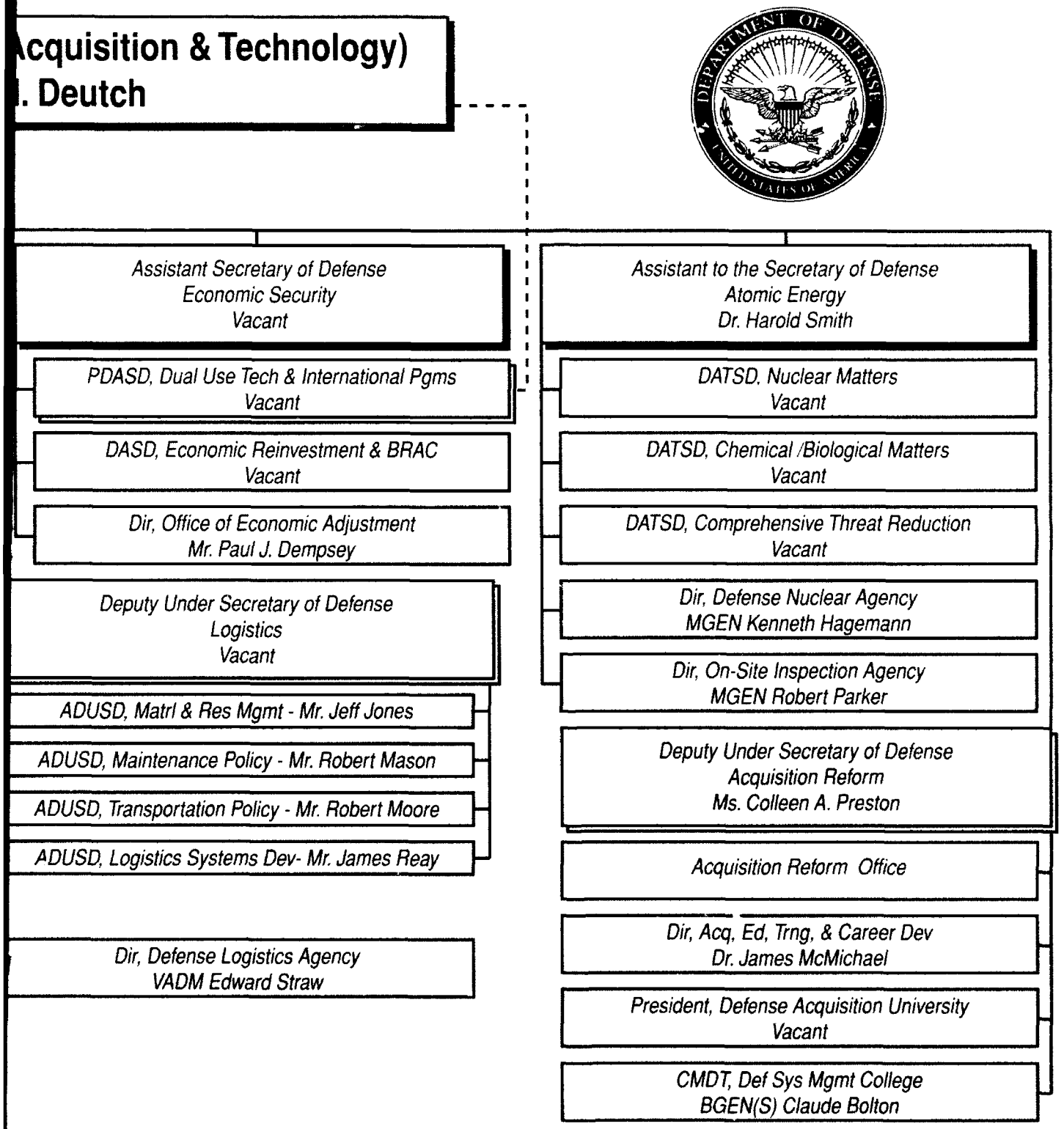
The sea change suggested by these statements has sparked consistently high levels of interest in the Panel's report ever since its publication. Despite its size, weight and cost ($47.20), the first 1,000 copies of the report printed by DSMC were rapidly snapped up by government agencies and members of the general public. A 100-page executive summary has been published for the Panel by the DSMC Press and will be available through the Government Printing Office early this summer.[3] In addition, DSMC support for the reform effort will continue under the leadership of Thomas J. Dolan, Jr., who has been appointed Acquisition Law Chair in the College's Executive Institute. In this new position, Mr. Dolan will be responsible for providing follow-on support to congressional committees, OSD, Panel members, and the DSMC faculty.

The initial congressional reaction to the Panel's recommendations came during a hearing before the Senate Armed Services Committee on March 10. In his opening remarks, Senator Sam Nunn called the project "a tremendous undertaking, in terms of both its scope and its importance," praising the Panel members and their staff for their efforts in a "very tight time table."[4] Echoing those sentiments, Senator Strom Thurmond, the Committee's ranking Republican, stated that the Panel had "fulfilled admirably the charter we laid out for them...." He added, "If enacted, their recommendations could help

(Continued on page 31)

(This page left blank intentionally.)


Under Secretary of Defense
Hon. John
Dir, Small & Disadvantaged Business Util - Mr. H. Crouch
Dir, Special Programs - BGEN Ralph Graham
Exec Dir, Defense Science Board - Mr. John Ello
Dir, Administration - Mrs. B. A. Reese
Principal Deputy
Under Secretary of Defense (Acq & Tech)
Vacant
Dir, Strategic & Sp Sys - Dr. George Schneiter
Dir, Tactical Systems - Mr. Frank Kendall
Dir, Test & Evaluation - Mr. Charles Adolph
Dir, Acquisition Pgm Integration - Mr. Gene Porter
Dir, Defense Procurement - Mrs. Eleanor Spector
Dir, CALS & EDI - Vacant
Deputy Under Secretary of Defense
Advanced Technology
Vacant
ADUSD, Advanced Technology Demonstration - Vacant
Office of the Thrust Leaders
Director
Defense Research & Engineering
Dr. Anita Jones
Dep DDR&E - Mr. Jack Bachkosky
Dir, Advanced Research Projects Agency
Dr. Gary Denman
Dep Dir, Research & Lab Mgmt - Vacant
Deputy Under Secretary of Defense
Environmental Security
Ms. Sherri Goodman
ADUSD, Environmental Compliance - Vacant
ADUSD, Environmental Clean-Up - Vacant
ADUSD, Environmental Conservation - Vacant
ADUSD, Pollution Prevention- Vacant
ADUSD, Installations - Vacant
Dir, Ballistic Missile Defense Organization
Vacant
As of 14 July 1993
LEGEND:
Exec Level
Non Career


cquisition & Technology)
. Deutch
Assistant Secretary of Defense
Economic Security
Vacant
PDASD, Dual Use Tech & International Pgms
Vacant
DASD, Economic Reinvestment & BRAC
Vacant
Dir, Office of Economic Adjustment
Mr. Paul J. Dempsey
Deputy Under Secretary of Defense
Logistics
Vacant
ADUSD, Matrl & Res Mgmt - Mr. Jeff Jones
ADUSD, Maintenance Policy - Mr. Robert Mason
ADUSD, Transportation Policy - Mr. Robert Moore
ADUSD, Logistics Systems Dev- Mr. James Reay
Dir, Defense Logistics Agency
VADM Edward Straw
Assistant to the Secretary of Defense
Atomic Energy
Dr. Harold Smith
DATSD, Nuclear Matters
Vacant
DATSD, Chemical /Biological Matters
Vacant
DATSD, Comprehensive Threat Reduction
Vacant
Dir, Defense Nuclear Agency
MGEN Kenneth Hagemann
Dir, On-Site Inspection Agency
MGEN Robert Parker
Deputy Under Secretary of Defense
Acquisition Reform
Ms. Colleen A. Preston
Acquisition Reform Office
Dir, Acq, Ed, Trng, & Career Dev
Dr. James McMichael
President, Defense Acquisition University
Vacant
CMDT, Def Sys Mgmt College
BGEN(S) Claude Bolton

(This page left blank intentionally.)

enormously to streamline the complex acquisition process in the Department of Defense. All of us in Congress must do everything we can to ensure that the substance of the Panel recommendations are enacted into law."[6]

Panel Findings

The Panel's findings were presented by RADM William L. Vincent (DSMC Commandant, who served as chairman) accompanied by several Panel members: F. Whitten Peters, Major General John D. Slinkard, Thomas Madden, Leroy Haugh, and Robert D. Wallick. In his opening statement, Admiral Vincent stressed that the goals and objectives established by the Panel at the outset of its review had been instrumental in "recommending changes that would streamline the defense procurement process in the 1990s, when dollars are expected to be fewer, work forces smaller, and superpower security threats less urgent."[7] He then highlighted the Panel's major initiatives.

Streamlining. The Panel rose to the challenge suggested by Senator Jeff Bingaman and many other observers by making a concerted effort to review procurement laws with a view toward their impact upon defense acquisition as a system. Consolidating and simplifying almost 300 statutes would permit the streamlined system of acquisition laws to be more easily understood, administered and implemented. Such streamlining also would reduce costs, providing sound defense for fewer taxpayer dollars.[8]

Commercial Items. The Panel devoted an entire chapter of its report to its recommendations for significant legislative changes to improve DOD's access to commercial technologies. Those recommendations include:

—Stronger policy language in 10 U.S.C. § 2301 favoring the use of commercial and nondevelopmental items;

The Panel reviewed more than 600 laws that it determined were relevant to this charter, eventually presenting specific recommendations for the amendment, repeal, deletion or consolidation of 298 of those statutes.

—A new definition of commercial items in 10 U.S.C. § 2302;

—A new subchapter dealing with uniform contract terms, exemptions from specified statutes, and pricing and audit of contracts for commercial items.

—An expanded exemption for "adequate price competition" in the Truth in Negotiations Act, 10 U.S.C. § 2306a, which applies to commercial items, and relief from inappropriate requirements for cost or pricing data when a competitively awarded contract for commercial items or services is modified.

—New exemptions from technical data requirements in commercial item acquisitions in 10 U.S.C. § 2320; and

—A new structure for "Buy American" restrictions in a proposed new chapter on Defense Trade and Cooperation.

Simplifying DOD Acquisition. Because there is a clear need to trim the Department's administrative overhead, the Panel recommended the creation of a new "simplified acquisition threshold"—initially to be set at $100,000—that would streamline more than 50 percent of all DOD contract actions over $25,000, while affecting less than five percent of its contract dollars. More specifically, the Panel made a four-part recommendation:

1. Establish a Simplified Acquisition Threshold at $100,000. While any level is somewhat arbitrary, the Panel strongly believed both that $100,000 is justified, and that the FAR can provide for appropriate competition and assurance of reasonable prices below this level.

2. Adjust Existing Statutory Floors to Not Less Than $100,000. The Panel identified some 30 laws requiring clauses in contracts at various values below $100,000. The threshold recommended here will simplify more than 50 percent of DOD contract actions over $25,000, impact only a very small percentage of total DOD spending, and conserve contract administration resources.

3. Reserve Purchases Under the Simplified Acquisition Threshold for Small Business. At present, all purchases below the small purchase threshold are reserved by statute for small business as long as there is a reasonable expectation that at least two small businesses will compete for the contract. The Panel believed it appropriate to continue existing practice as the simplified acquisition threshold is raised to $100,000, by reserving contracts below this level for small business. In addition, the Panel intends that awards under the 8(a) program would also be made using simplified procedures.

4. Simplify and Modernize Contract Notice Procedures. In order to ensure broader public access to streamlined procurement opportunities, the

Panel recommended increased use of electronic procurement notice and contracting methods, balancing its recommendation to raise the threshold for synopsis in the *Commerce Business Daily* to the simplified acquisition threshold. Those recommendations would also require all solicitations above $10,000 to be posted locally, preferably through the use of electronic bulletin boards, 800-numbers or other methods of electronic advertising.

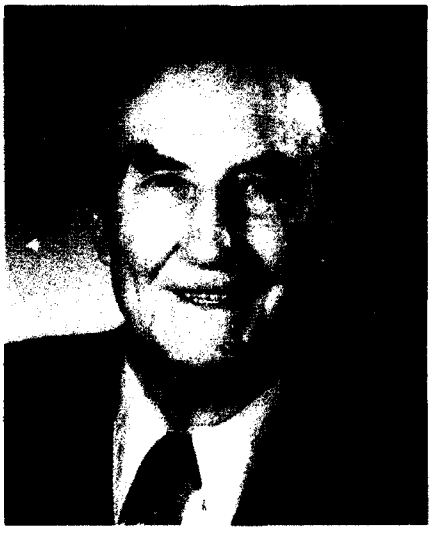
Socioeconomic Laws. The Panel's concern for small business as well as its mission of simplifying acquisition law led to its recommendations for a consolidated chapter of Title 10 which would detail the laws pertinent to DOD socioeconomic requirements. The Panel believed that such a step is warranted in view of the need to enumerate those laws more clearly, streamline those which must be administered by a much-reduced DOD work force, and to reduce the implementation of socioeconomic statutes by contract clause. The Panel also recommended that Congress replace existing small business legislation—much of which is contained in frequently changed uncodified law and some of which is internally inconsistent—with a comprehensive and consistent small business code in order to improve access by small business to capital, training and management support.

Contract Formation. The Panel's analyses and recommendations on the contract formation statutes were intended to improve and strengthen the competitive process, including competition for commercial and nondevelopmental items. In its proposed changes to the baseline statute on congressional defense procurement policy (10 U.S.C. § 2301), the Panel sought to provide a clear recognition between the need for an optimum balance between efficiency, full and open access to the procurement system, and sound implementation of socioeconomic policies. The Panel also recommended clear policies on preferences for commercial and nondevelopmental items, appropriate allocation of risk, and fair and expeditious resolution of protests and disputes through uniform interpretation of laws and regulations. The Panel also reviewed four of the major statutes which regulate competition in government contracting:

—In 10 U.S.C. § 2304 the Panel recommended an amendment to delete the authority and rule structure for master agreements for advisory and assistance services, substituting a completely new authority. This new section would set forth in law the recognition of the legitimate need for contracts that do not procure or specify a firm quantity of supplies or services, the use of proper delivery or task orders under such contracts, and the criteria that such contracts and delivery orders under them must meet.

—In 10 U.S.C. § 2305 the Panel recommended a number of amendments designed to help eliminate needless protests, primarily by encouraging timely debriefings of unsuccessful offerors and agency-level protest resolution.

—In 10 U.S.C. § 2306 the Panel recommended an amendment to delete the delegable requirement that the "head of the agency" approve the use of a cost-reimbursement or incentive contract, because this determination is often duplicative.



Senator Strom Thurmond, (R-S.C.), ranking minority member, Senate Armed Services Committee.

—In reviewing 41 U.S.C. § 416, the Panel concluded that the statutory minimum time periods that offerors have to prepare their bids and proposals after notice is published in the *Commerce Business Daily* may be excessive for commercial items. The proposed amendment exempts commercial items from the existing time periods and directs the Administrator for Federal Procurement Policy to issue rules prescribing the appropriate time period.

The Truth in Negotiations Act (10 U.S.C § 2306a, or "TINA") is an important statute affecting many large-dollar contracts awarded without price competition as well as many significant contractual modifications. The Panel concluded that the threshold for application of this statute should be stabilized at $500,000, but also recommended adding a specific exception to this statute for modifications to contracts or subcontracts for commercial items or services. In line with its initiatives on commercial items, the Panel recommended a new subsection that would expand and clarify the exception for adequate price competition providing that a procurement can be exempted from TINA if: (1) the price is fair and reasonable, and (2) the item is to be purchased from a company or business unit that produces the same or similar item for the commercial market using the same or similar commercial production processes used to produce the offered item for the government.

The Panel's most important recommendation on the 19 research and development statutes which it reviewed is to amend 10 U.S.C. § 2358, "Research Projects," to clarify that advanced, as well as basic and applied, research and development should be included in the scope of authority granted in the statute and that these authorities should be clearly provided

to both the Secretary of Defense and the Secretaries of the military departments.

Procurement Protests. The Panel's recommendations stressed the need for:

—Timely and meaningful debriefings of disappointed offerors.

—Establishment of a reasonable period of time for resolving protests under the General Accounting Office (GAO) express option.

—Provision of payment of government costs when protests that lack merit are filed or pursued before the GAO or the General Services Board of Contract Appeals.

—Abolishment of District Court jurisdiction over protests and expansion of the jurisdiction of the Court of Federal Claims.

—Establishment of a single judicial forum, the Court of Federal Claims, for consideration of bid protests.

These recommendations are intended to improve the existing bid protest system, offering the prospect of avoiding precipitous protests while gaining greater uniformity in both decisions and practice among current bid protest forums. Should these reforms be enacted, the bid protest system will become more efficient, thereby saving resources for protesters and agencies alike. The Panel also recommended that Congress consider a more far-reaching reform which would replace the four existing bid protest forums with a single bid protest forum in the executive branch.

Contract Administration. The major challenge faced by the Panel in this area was to consolidate a large number of statutes that regulate—and often over-regulate and complicate—day-to-day contract management. Its key recommendations in this area include:

Contract Payment. The Panel recommended consolidating a number of the 15 duplicative and dispersed payment laws into a single statute, adding statutory guidance on making payments with special attention to the needs of small businesses. The Panel also recommended amending the Prompt Payment Act (31 U.S.C. § 3901-3907) to change the procedures for computing discounts, in order to correct recent statutory changes to this act, which have slowed rather than expedited payment to contractors.

Cost Principles. Consistent with its objective of placing policy guidance and basic concepts in law while leaving implementation to regulations, the Panel recommended that 10 U.S.C. § 2324 ("Allowable Costs Under Defense Contracts") be amended to eliminate detailed proscriptions regarding individual cost elements, and to provide guidance on total costs, on what constitutes a cost, and cost allowability.

Contract Audit and Access to Records. Of the 21 laws identified in this area, 10 U.S.C. § 2313 (Examination of Books and Records) received the most scrutiny. The Panel recommended the enactment of a consolidated audit and access to records statute, eliminating duplication or outmoded elements, while adding exemptions and new categories of contracts to be audited.

Intellectual Property. Although the importance of intellectual property in DOD acquisition is not always well understood, this critical area involves the ownership and rights of both tangible and intangible property. It affects the development, manufacture and operation of defense equipment, including such things as software, data bases, patents, copyrights, information systems, and (perhaps most importantly for defense manufacturing) the technical data pertaining to hardware acquired by DOD. The Panel's recommendations in this area recognized that there has long been a dichotomy of interests between the government and industry over the ownership of technical data developed under, or required for the performance of, a DOD contract. This dichotomy has impeded technology transfer between the government and industry, raising costs, slowing innovation, and possibly even preventing products from moving to the commercial market. The Panel made a number of detailed recommendations to improve the transfer of data between government and the private sector. Its report also suggested that the government's inherent data rights should, as a matter of policy, be balanced by a recognition of the contractors' rights in data developed in whole or in part at private expense. Where the government's needs include access to that proprietary data, DOD should negotiate with the contractor for whatever rights are necessary.

Industrial Base and Manufacturing Technology Issues. Although the Panel's review of these issues was limited by the sweeping changes enacted by the FY 1993 Defense Authorization Act, it recommended consolidations of a large number of service-specific statutes that were either obsolete or that provided overlapping authorities. Consolidations were also recommended in two other areas: weapons testing and unit cost reporting. While the Panel recognized the overriding importance of, respectively, effective cost controls and rigorous operational testing, its intent was to suggest uniform procedures and measures of merit—and a common basis for management decisions by leaders in both Congress and the DOD. With respect to depot-level maintenance in an era of rapid downsizing, the Panel felt that the usual percentage tests for in-house vs. outside contracting had become counterproductive. It recommended instead that the Secretary of Defense be given more flexibility, both to regulate the workload of these depots in the most cost-effective manner, and to provide for appropriate competition to improve efficiency.

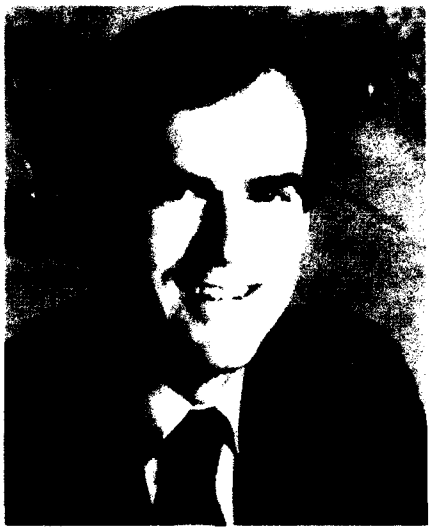
Standards of Conduct. The Panel assembled and reviewed those statutes that directly or indirectly affect the defense acquisition process by imposing limitations upon the conduct of government employees, contractor representatives or contractors. Because the majority of those statutes involved laws of general application, the Panel ultimately focused on several key issues. On the False Claims Act, for example, the Panel recognized the great effectiveness of this "whistleblower" statute; but, in order to avoid conflicts of interest, it recommended amendments to preclude *qui tam* suits filed either by government employees acting on knowledge gained during the course of their employment or by anyone using information learned through the operation of a voluntary disclosure program. The Panel also recommended that the courts be given authority to reduce plaintiff awards in *qui tam* cases where the plaintiff played a role in the fraud or deliberately delayed reporting it.

On ethics laws affecting those engaged in defense procurement, the Panel concluded that, although the recent promulgation of uniform, government-wide standards by the Office of Government Ethics had met a long-standing need, these new standards had now made a number of statutes obsolete. Repeals were recommended for them as well as a number of overlapping "revolving door" laws. Repeal of the Byrd Amendment was also recommended because the Panel believed that it duplicates requirements located elsewhere and imposes unnecessarily burdensome record-keeping requirements on the DOD and its suppliers.

Prospects for Reform

Despite the initial enthusiasm that greeted the Panel's report, most observers expect that the enactment of its proposed reforms will be a long process. The scope and length of the Panel's report, as well as personnel transitions now under way in the executive and legislative branches, are important factors. The Senate is expected to hold additional hearings later this summer in order to hear the views of the DOD and other government agencies as well as those of industry. The House Armed Services Committee, now under the leadership of Representative Ron Dellums, had not scheduled hearings on the Panel's report by press time but was said to be conducting an intensive study of its recommendations. A similar review by the General Accounting Office should also be completed during the summer.

In his testimony at the Senate hearing, Major General Slinkard emphasized "that a really concerted, cooperative effort between the services, OSD, and the Congress will be necessary to press on with this."[9] RADM Vincent—who retired after a distinguished 30-year career several weeks following that hearing—also stressed that this cooperative approach will be essential in managing a process that, to succeed, must balance the interests of many different constituencies. Equally important was the need to think of the Panel's recommendations as a "system solution meant for the long haul." He concluded, "Congress took over ten years to enact the reforms of the Commission on Government Procurement, but we just can't wait that long now. Everything else has changed; our system of acquisition laws must as well."[10]



Senator Jeff Bingaman, (D-N.M.), a leader in the streamlining effort.

Endnotes

1. Section 800, P.L. 101-510 (FY 1991 Defense Authorization Act).
2. President Bill Clinton, "Technology for America's Economic Growth," Speech by the President, Sacramento, Calif., Feb. 22, 1993, p. 22.
3. Dr. William J. Perry, Statement Before the Senate Armed Services Committee, Feb. 25, 1993, p. 3.
4. The executive summary can be ordered through GPO channels under the title, *Streamlining Defense Acquisition Laws. Executive Summary: Report of the DOD Acquisition Law Advisory Panel.* (March, 1993). The GPO stock number is 00P-020-0129P-0.
5. Senator Sam Nunn, Opening Statement, *Hearing to Review the Report of the Advisory Panel on Streamlining and Codifying the Acquisition Laws*, Senate Armed Services Committee, March 10, 1993, p. 6 (typed transcript).
6. Senator Strom Thurmond, Opening Statement, *Hearing to Review the Report of the Advisory Panel on Streamlining and Codifying the Acquisition Laws*, Senate Armed Services Committee, March 10, 1993, p. 8 (typed transcript).
7. RADM W. L. Vincent, Prepared Statement of the Chairman, DOD Advisory Panel on Streamlining and Codifying Acqusition Laws, before the Senate Armed Services Committee, March 10, 1993, p. 4.
8. Ibid. The issues subsequently discussed in the section are adapted from RADM Vincent's prepared statement.
9. Testimony by Major General John Slinkard, USAF, in *Hearing to Review the Report of the Advisory Panel on Streamlining and Codifying the Acquisition Laws*, Senate Armed Services Committee, March 10, 1993, p. 76 (typed transcript).
10. Interview with the author, May 3, 1993.

PROCUREMENT INTEGRITY

A Level Playing Field

Chris Scott

In 1988 the media riveted public attention on procurement integrity by reporting on the FBI's "Operation Ill Wind" investigations, targeted to uncover and prosecute purported unethical and criminal Department of Defense procurement practices. Bribery of high-level officials and release of "inside," source-selection sensitive information were at the heart of the investigations. During the next couple years, the Congress and White House, with input from industry, negotiated the law as it applies today, and amended Section 27 of the Office of Federal Procurement Policy Act. This was written into the Federal Acquisition Regulation under Section 3.104. The Act intended to put more meat on the skeletal guidelines for preserving a "level playing field" among competing contractors. You should keep in perspective that although Section 27 (the "Act") advertises increased attention on the acquisition process, integrity of the government-industry relationship is not a novel concept and, in fact, was addressed in preceding statutes.

The Act targets procurement personnel activities during critical stages of the procurement process. Generally, during the conduct of a procurement, competing contractors — which term includes their officers and a host of representatives — should not knowingly: (1) communicate overtly with a government procurement official regarding future employment or other business opportunities; (2) offer gratuities to a procurement official; or (3) solicit or accept proprietary or source-selection information pertaining to that procurement before contract award. These same general guidelines apply in complementary fashion to government procurement officials: not to seek employment, receive gratuities, or disclose sensitive procurement information. The Act elaborates on the government activities relative to post-employment and source-selection information disclosure.

Two-year Restriction

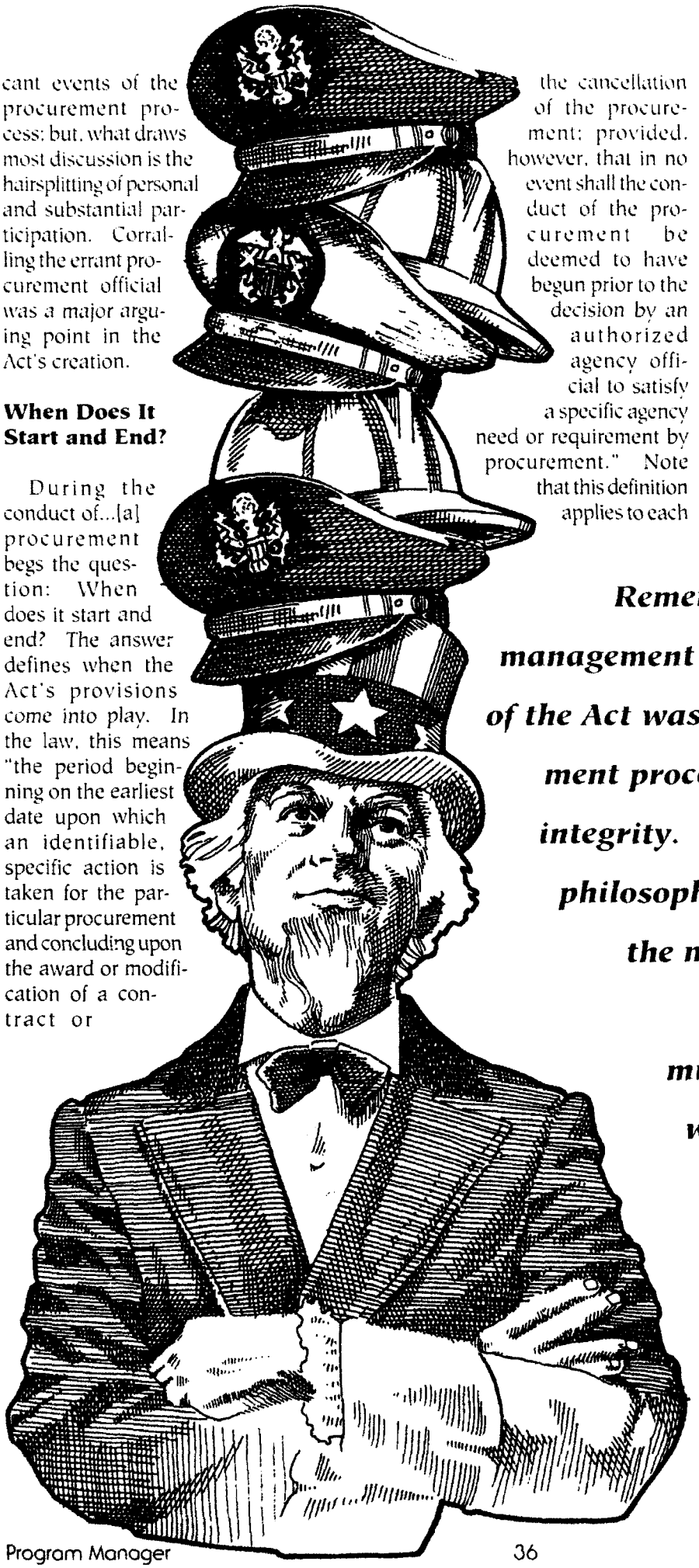
Procurement officials are restricted from working on a related contract for a competing contractor within 2 years after his/her last personal and substantial participation in the related procurement. This restriction also applies to first- or second-tier subcontractors with individual contract value greater than $100,000; who significantly aided the prime contractor in the prime contract negotiations with the government, or who were personally selected or recommended for selection to the prime contractor by the procurement official. For proprietary or source-selection information, the Act delineates that such information should be released only to individuals approved by the head of the agency or designee (down to the contracting officer).

As a thumbnail sketch, the above may seem straightforward when, in fact, the opportunity to invoke the law hinges on interpretation of terminology. Within the Act, effort is made to adequately define terms like "competing contractor," "participated personally and substantially," "knowingly," and other terms that in common usage wouldn't appear to require special definition. It is the definitional clarification of these terms that serves the purpose of limiting liability under, and invocation of, the law. However, as a program manager, you should focus initially on three terms that lie at the heart of acquisition — "procurement official," "during the conduct of...[a] procurement," and "source-selection information." While other terms are more definitional in their applications, these last three get to the soul and risk of the procurement process. Awareness of their limiting language can help the program manager preserve integrity of the procurement process.

In the FAR, a procurement official is any civilian or military official or employee who participates personally (directly) and substantially (significant involvement) in any number of procurement-related activities: drafting, reviewing or approving a specification or statement of work; preparing or developing the procurement request; and, the string of events from solicitation preparation, through proposal evaluation and negotiation, to contract formation, review and approval. These activities fairly cover signifi-

Mr. Scott is a Professor of Systems Acquisition Contracting, DSMC.

cant events of the procurement process; but, what draws most discussion is the hairsplitting of personal and substantial participation. Corralling the errant procurement official was a major arguing point in the Act's creation.



When Does It Start and End?

During the conduct of...[a] procurement begs the question: When does it start and end? The answer defines when the Act's provisions come into play. In the law, this means "the period beginning on the earliest date upon which an identifiable, specific action is taken for the particular procurement and concluding upon the award or modification of a contract or the cancellation of the procurement; provided, however, that in no event shall the conduct of the procurement be deemed to have begun prior to the decision by an authorized agency official to satisfy a specific agency need or requirement by procurement." Note that this definition applies to each contract award or modification, thus setting up a string of applicable time frames. Drafting a specification or statement of work is the first example listed in the FAR when it may be decided that a procurement has started. Even this definition has been argued as an inconclusive statement of "this is the start." The burden now lies within each agency's purview to define when a procurement starts; within DOD, this has led to Service- and activity-specific guidance, which generally has redefined the start to occur later in the process. For example, one activity considers the start to be when the final solicitation is ready for distribution to the contractor(s).

Remember, from a program-management perspective, the intent of the Act was to tweak our procurement process to a tighter level of integrity. At the macro level, the philosophy is commendable. At the micro/operational level, the opportunity for mistakes — unwitting or willful — are countless.

Source-selection information is defined by the Act as that which (1) the disclosure of which to a competing contractor would jeopardize the integrity or successful completion of the procurement concerned; and, (2) is required by statute, regulation or order to be secured in a source-selection file or other facility to prevent disclosure. This broad guidance then includes a list of candidates generally falling under cost or price data cat-

egories, selection plans, evaluations and rankings, or information specifically marked as "SOURCE SELECTION INFORMATION" and accorded that protective status by the agency head or designee (often the contracting officer). Again, it has been the separate Service's decision to expand or clarify these terms.

Contracting officers, procurement officials and agency heads must certify their compliance with the Act in procurements exceeding $100,000. Regarding a procurement official's preconditions to performance of duties, there is an absolute requirement to certify, without regard for procurement dollar value. Competing contractors (but not subcontractors, unless requested by primes) must certify compliance, both through solicitation and contract provisions. Violations of the law can involve many remedies, among them cancellation of the procurement action, disbarment, termination for default, and even civil and criminal penalties.

Pleas of Ignorance

To avoid pleas of ignorance after the fact, the Act levies an obligation to inquire when it's unclear whether or not the law has application in any one situation, regarding process activities and conduct of players. For procurement process issues, your first point of contact is the contracting officer. Each agency is required to have an ethics advisor whose expertise and counsel should be taken for personal conduct and employment discussions. Some advisory offices have established training programs to promote adherence to the law.

So, what should the program manager take away from this compact introduction? Hopefully, more questions: What are my local guidelines on procurement integrity; who are the program, role-critical, procurement officials (or other agents) whose conduct should come under scrutiny; at what stages of the procurement should I be most wary of the process' integrity; what's the breadth of source-selection information I should be careful to secure properly; how do I use this new knowledge to help manage the program without fear of spoiling the designed integrity of our acquisition operations?

Level of Integrity

Remember, from a program-management perspective, the intent of the Act was to tweak our procurement process to a tighter level of integrity. At the macro level, the philosophy is commendable. At the micro/operational level, the opportunity for mistakes — unwitting or willful — are countless.

Managers of the acquisition process, therefore, should use this introduction to hone questions about how the Act's provisions apply to their particular situations, toward sharpening subsequent conversations with professionals assigned to help keep integrity in the procurement process.

DEFENSE ACQUISITION HISTORICAL CENTER

Contractor Team Begins Work

The Department of Defense Acquisition Historical Center received a major boost in early May when a contractor team began work to develop and define further the Center's role, policies and procedures.

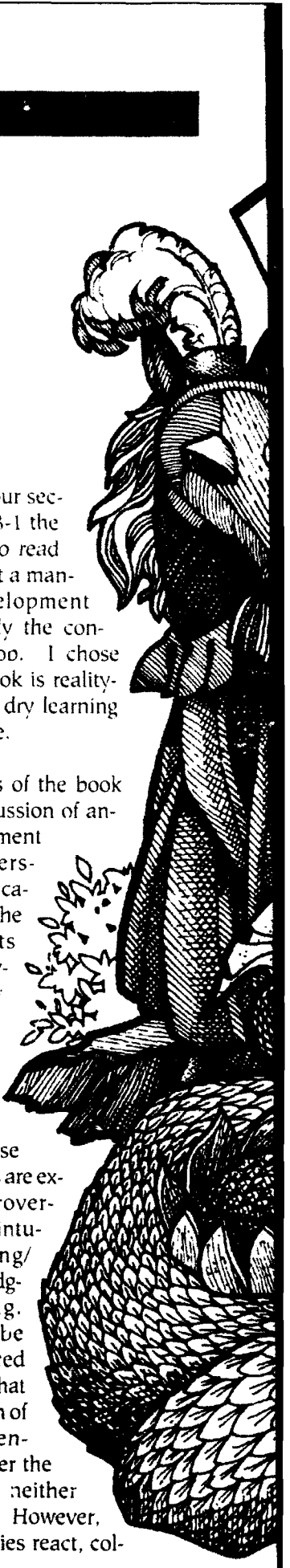
The Center, established at DSMC in 1992 by Under Secretary of Defense for Acquisition Don Yockey, will serve as an archives for the collection and dissemination of acquisition information. Such a repository does not exist in the Department. Information will be collected voluntarily from various sources and made available primarily through an electronic database clearinghouse. The project's first phase calls for options to be presented by November on the direction and goals DSMC will select for FY 1994 and beyond.

The team consists of prime contractor Arist Corporation, of Alexandria, Va., and History Associates, Inc., of Rockville, Md. The DSMC project manager is Wilbur D. Jones, Jr., Center Director.

EMPOWERING YOUR TEAM

Is ZAPPing the Answer?

Steve Gierhart



Near the middle of my second month of Program Management Course (93-1) at the Defense Systems Management College (DSMC), all students received a copy of class biographies. I, like everyone else, looked at my photo, sighed and thought "I hope this really isn't me." The person in the mirror never seems to match the photo. It should not surprise us, then, when we find out that others also perceive us differently than we perceive ourselves.

This incident is the catalyst for conveying some important lessons learned from the management development exercise at DSMC and my reading of a wonderful book by Dr. William Byham entitled *ZAPP! The Lightning of Empowerment.*

Talking a Good Game

It can be a critical mistake for managers not to correct self-deceiving images of themselves. We talk a good game on total quality management (TQM). We say and often do work toward our ultimate challenge of customer satisfaction. However, we forget that TQM is also a process-driven challenge of efficiency and effectiveness—an engine of effectiveness driven by the empowerment of the team and individual, not solely by the manager.

From that perspective I would comment that most managers do not self-evaluate accurately. Sure, we can admit we are part of the problem. But we are often blissfully naive and ignorant of how we are part of the problem. Moreover, removing ourselves as obstacles can be as difficult as understanding *how* we became the obstacle. Regardless, it goes back to the mirror. A manager may look like a donkey to everyone but himself.

The manager is most effective when all people working the issue are effective. The effectiveness quotient is dependent not only on the efficiency of the process but on the right number and types of knowledgeable and contributing team members who are motivated. If they are not motivated, a big contributor can be the self-deceived manager, the manager who is often the most technically knowledgeable individual but who is unable to harness the superior capability and knowledge of the team. Make the manager effective with the team, and you make the process significantly more effective. Importantly for you and others, "doing our eight to ten" becomes something to look forward to, instead of dreading.

Dry Reading Made Enjoyable

Now, what does ZAPP! have to do with this? Well, Professor Mary-jo Hall assigned our section of Class 93-1 the responsibility to read and write about a management development book and apply the concepts to our job. I chose ZAPP! The book is reality-mixed fantasy; dry learning made enjoyable.

My synopsis of the book weaves in discussion of another management tool, the Myers-Briggs Type Indicator (MBTI). The MBTI suggests that our behavior is powerfully shaped by our preferences, which are categorized along four dimensions. Those four dimensions are extraversion/introversion, sensing/intuition, thinking/feeling and judging/perceiving. Anyone can be tested and placed in a preference that is a combination of the four dimensions. Whatever the category, it is neither good nor bad. However, all type categories react, col-

Mr. Gierhart is Chief of the Program Management Office, Air-to-Air Missile Project, Program Executive Office, Tactical Missiles, Redstone Arsenal, Ala.

Program Manager

lect information and make decisions somewhat differently. By knowing these preferences about ourselves and our employees, managers can be more effective—and minimize the possibility of becoming the donkey in the mirror.

Bugle Call to Wake Up

What follows is more than a school prerequisite. It is a bugle call to awake and clean our mirrors. Then, our rice bowls need to be shaken. They are full of bugs.

Employees must feel they have the responsibility and power to kill dragons and put out fires... that's ZAPPing!

Dr. Joe Mode and Mr. Steve or How I Stopped Worrying and Learned to Love the ZAPP! They call me MISTER Steve. I am an ENTJ (an extravert, intuitive, thinking and judging personality sometimes known by other expletives)—bad news for the 20 people in my division. You see, I tend to be tough-minded, impersonal. I don't consciously hurt people's feelings. Before Joe Mode appeared I thought I cared about my people; er, about our team. But I tend to cut them off when they have ideas, take control. As Joe Mode would say, "I really Sapp'em."

It is not that ENTJs are awful. On the contrary, we have excellent traits to contribute. We are analytical and consistently rely on reasoning capabilities to dissect and effectively organize ideas and methods of putting out little and big (dragon) fires. We tend to hog the fire hose ourselves. We love putting out fires. We forget others do too. We are visionary; in fact, we love to let people know just how visionary we are.

As you see, it is not a balanced picture. The good and the bad sometimes present the ugly; that's SAPP. If I listen to Joe, I can empower people; that's ZAPP.

ZAPP is letting others on my team take control of their jobs; letting each see how to contribute to the team; letting the ZAPP give a warm and fuzzy feeling of accomplishment; giving them a chance to put in more than the eight hours.

But, I'm rambling without letting you know who Joe Mode is and, more importantly, explaining the power of *ZAPP*. Joe Mode and I crossed paths through a book I read during the Program Management Course at the Defense Systems Management College. The book is by William Byham and Jeff Cox and is called *ZAPP! The Lightning of Empowerment*. It describes the remarkable Joe Mode and his employee, Ralph Rosco, inventor of the *Ralpholator* and discoverer of the more remarkable twelfth dimension, the realm of *ZAPP*.

In a nutshell, Joe was supervisor of Department N at the Normal Company, which manufactured and sold the normalator. The Normal Company was organized under the credo of "The managers do the thinking. The supervisors do the talking and the employees do the doing." That seemed to work before the Japanese found Dr. W. Edwards Deming. Then, the (Berlin) Wall Fall broke the joist of the (Defense Budget) War Floor.

The good manager gives proper directions (boundaries and goals, not how to solve the problem), enables knowledge and resources, and provides support.

Joe Mode, an organized supervisor, always wrote down problems as he saw them—and the symptoms. None of the employees seemed to enjoy the work. They were unproductive and bored—mostly zombies going through motions dictated by Joe and the Normal organization.

Department N(ormal)

Ralph also was like this, except one day in the remote area of Department N where he worked, the idea of the *Ralpholator* came to him. Ralph designed it undisturbed even though Joe responded negatively—and, the *Ralpholator* worked! Ralph fired it up and vanished into what became known as the twelfth dimension where, in the eyes of the beholder, reality was warped into literal fantasy images of how the Normal Company bungled through the day. Dragons, large and small, happily started and spread fires that wrecked havoc in the workplace. When fire hoses were brought out, supervisors dressed in silly outfits, grabbed the hoses and tried to put out the fires, but they were largely ineffective. Department employees plodded about as zombies or mummies, unable to contribute much during the day except the exact process or procedure programmed into their memories. Most importantly, when the faintest glow of independence and ideas started to trickle out, a manager or supervisor could easily stop the glow with a *SAPP* which sounded much like air evaporating from a balloon.

Department Z(app!)

The difference, however, as Ralph found out, was in Department Z. Here, to his amazement, people seemed to meet with success against the dragons. The supervisor, Lucy Storm, did not take the fire hose. With a few words from Lucy, dents and fire-burnt armor reshaped and shined. The employee knights then went back, forced dragons out and put out the fires. They worked as teams, instead of bumbling against each other. Everywhere Department Z glowed from the fire and lightning of a strange energy emanating between team members and from Lucy. It was to be called *ZAPP*.

Happily for the rest of us and the Normal Company, Joe Mode accidently found out about both *ZAPP* and the twelfth dimension. With his pizzazz for the written word, intellectual curiosity and tolerance for new ideas that worked, Joe Mode pressed Ralph, and later Lucy, to dissect and analyze important aspects of *ZAPP* and how they worked. Moreover, he wrote them down.

Now, the lightning of *ZAPP* can work for me!

What I Will Do

When I return to my job in June, I intend to initiate actions and personal and office changes that I hope will cultivate the climate for enzapping, instead of ensapping. First, one month

before leaving I will call my administrative officer and ask her to buy copies of *ZAPP!* with the government credit card. Hopefully, they will be there when I return. Then, I will ask first-line supervisors within my division to read the book so that we have a common understanding of *ZAPP*.

We will have a conference on the book and management tools like MBTI. If appropriate, we will contract with the Defense Systems Management College to have project employees take the MBTI. My supervisors and I need to understand what motivates each employee within the project office. To be more effective, we must begin to work as a team, trust employees, and help problem employees develop a positive attitude toward their work, even if that means extra coaching. I may have logos printed for distribution, inspired from the book. We will work toward consistent development of each member's self-esteem with empathy and listening, asking for their help to solve problems, instead of telling them how to solve problems. As a manager, I will focus on creating the environment where *ZAPPing* is a reality. I will provide resources and remove barriers.

Sharing Responsibility

Key in this process is for the managers to offer help without taking responsibility, sharing responsibility without abandoning it. Hopefully, we will develop this method through situational control of the team member and the unique circumstance at hand and without over-control. While I have not used teams in the past (vs. the individual or the branches within my division), by using other tools I expect to learn in the Program Management Course and this book, I will strive to find situations where the team approach will be more successful in accomplishing a task or putting out a fire.

I recognize that *ZAPP!* embodies many precepts and concepts of total quality management, to which we give lip service without trying to understand. Already, my experience in the DSMC Program Management Course has helped me appreciate total quality management.

ZAPP! has brought that into focus more than any TQM briefing or video lesson to date.

Epilogue

Here are Joe Mode's Key Principles of *ZAPP*.

—Maintain self-esteem

—Listen and respond with empathy

—Ask for help in solving problems (The team is superior in capability and knowledge than the manager alone.)

—Offer help without taking responsibility (The soul of ZAPP)

—When delegating responsibility, set controls but:
Don't overcontrol
Don't abandon control
Use situational control, including performance feedback

—To channel action, establish:
Key result areas (What is the direction we want to go?)
Measurement criteria (How do we know we are progressing?)
Goals (How do we know we have finished?)

—The good manager gives proper directions (boundaries and goals, not how to solve the problem), enables knowledge and resources, and provides support.

I don't know about you, but I prefer to see a real person in the mirror, not a donkey in a costume. Let the *ZAPP* brighten your day. Do what you can to reverse the donkey paradigm.

MANAGING TECHNOLOGY

Enhancing the Daily Management

Gerald Moeller

The United States' recent track record for growing and applying emerging technologies relative to many of its foreign counterparts is not good. Recent documentaries indicate that an average of 40 years passes between technology conception and deployment throughout an industry.

The high-technology arena fares a bit better with an average of 20 to 25 years. By comparison, many of America's trading partners have reduced the time to transition technology from the research and development (R&D) laboratory to the manufacturing floor to a matter of 15 to 20 years. Additionally, these foreign competitors are now attracting top-flight U.S. research and development talent to their shores and have significantly increased their internal generation of R&D personnel. The United States must dramatically improve the way it perpetuates technology to remain economically and, ultimately, militarily competitive. This paper offers suggestions on improving the daily management of technology. A forthcoming article will offer suggestions on national technology growth stimulating.

Introduction

The last two decades can be described as the era of technological explosion, driven in part by increasing competitive pressures to produce acceptable products and services to consumers at lower prices, and by the Cold War arms and space race. While the increased introduction of these technologies in the workplace offer great promise for productivity and quality improvement, it is doubtful whether there is adequate infrastructure in place to manage their application effectively. The need, therefore, exists for examining some basic technology management questions that frequently surface.

1) What is encompassed in the concept of managing technology?

2) What are the necessary managerial qualities and organizational structures required to attain efficient technology development and implementation?

3) What are the new technologies that can be harnessed to significantly accelerate technology growth in total?

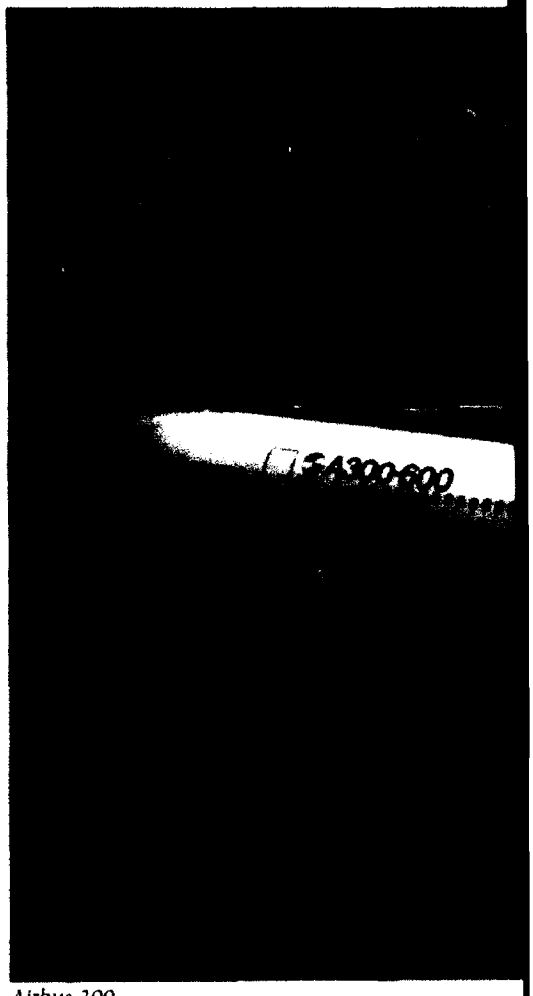
Managing Technology Defined

Managing technology at the enterprise level can be defined in many ways, and none are necessarily right or wrong. Differences usually occur in the scope of the elements comprising technology management. The proposed definition offered focuses on four major elements including:

1) A product life-cycle perspective; i.e., from concept to disposal

2) The leveraging of human resources and other assets by optimizing the relationship among the enterprise's internal technology functions

3) Optimizing the integration of activities between the enterprise's technology groups and external technology groups having common technical interests



Airbus 300.

Mr. Moeller is an industrial engineer assigned to the US Army Industrial Engineering Activity, AMXIB-P, Rock Island, Ill.

4) The process of integrating science, research and engineering with product development and manufacturing to attain the enterprise's goals and objectives effectively, efficiently and economically.

Next-generation Technology

Enterprises control the current technology used to design and produce products, services and capabilities. However, technological change in large steps, commonly called "next generation technology," opens dominant new competitive positions during transition from current controls to next-generation technology. Examples include electrostatic copying, laser printing, atomic energy, guidance, stealth aircraft, etc. In the transitioning from old technology to the next generation, new enterprises are created and old enterprises fail.

The enterprise strategy needed for managing technology requires looking beyond the financial budgeting practices currently used for business planning. Such practices encourage small step improvements in existing technologies. To be competitive in today's markets, the enterprise must plan for the implementation of next-generation technology. Implementing next-generation requires a significantly shorter product-development life cycle with a keen focus on producibility and process costs.

Vigilance, vision, energy and competence are executive qualities necessary to accomplish the strategic reorientations required for next-generation technology. A strategic team is needed because next-generation technology requires a portfolio of competence: engineering, marketing, manufacturing, personnel and finance. One major problem associated with bringing about the strategic reorientation required for next-generation technology is consensus creation and carrying out needed organizational changes. A corollary problem is revising strategic reorientation as experience points out mistakes and/or weaknesses in the vision.

Organization theorists have argued that effective organizations experience periods of relative stability interrupted by short strategic reorientations. Organizational change can be viewed as a kind of evolution stimulated by, and responding to, change in exogenous conditions. Effective top-level leadership is able to make this strategic reorientation without damaging the enterprise infrastruture.

Conversely, ineffective top-level leadership generally has been the major reason for enterprise decline during next-generation technology transition periods.

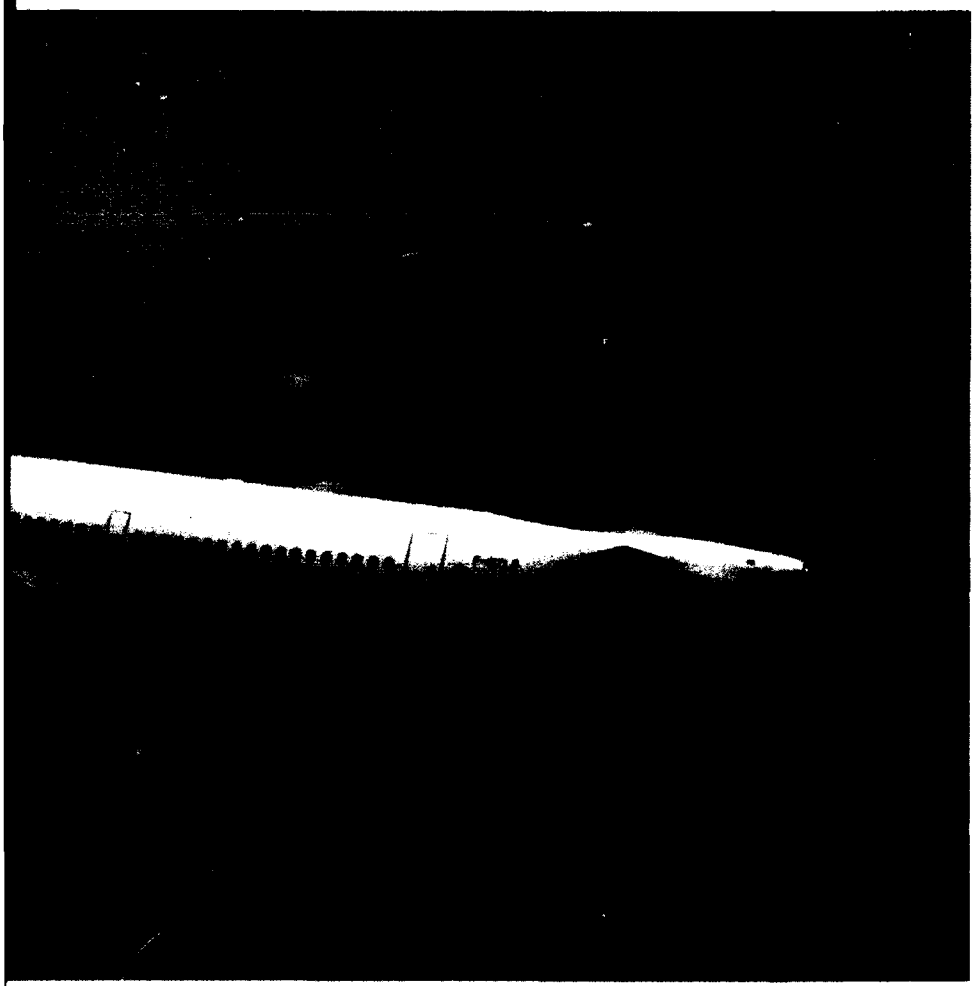
Research studies suggest the following concepts be used in preparing for next-generation technology.

—Enterprise research must strategically plan for next-generation technology, best accomplished through the aid of an industrial/university/governmental research consortium.

—Enterprise management must plan tactically for next-generation technology, best accomplished through a joint effort among the enterprise's organizational divisions.

—Agile manufacturing is required to enable shortening the product-development life cycle and to provide a means of economically manufacturing small volumes.

—Long-term financial planning that focuses on attaining adequate capital to finance technology's development needs is required.



(Photo courtesy of European Airbus Industrie Corp.)

—Personnel planning and development are required to transition knowledge bases and skill mixes into next-generation technology.

—Organizational structures and culture should be designed to encourage innovation, foster an entrepreneurial *modus operandi*, and accommodate strategic reorientations.

It is important for the enterprise to structure a technology policy that creates or sets the stage for realization of innovative aspirations. Some ways to accomplish that objective.

—Concentrate on selected technology selection, specialization or embodiment.

—Improve the level of competence, emphasis on basic research, applied research, and/or development engineering.

—Identify sources of technological capability, internal vs. external.

—Invest in research and development, and staffing.

—Be sensitive to competitive timing, initiative vs. responsiveness.

—Establish a responsive research and development organization and policies, flexible or structured.

The integration of technology strategy into the enterprise's business plan should be accomplished early and updated as required. The following considerations are recommended.

—Identify all distinct technologies and subtechnologies in the value chain.

—Determine the likely path of change of key technologies.

—Determine which technologies and potential technological changes are most significant for competitive advantage and industry structure.

—Assess the enterprise's relative capabilities in important technologies and the cost of making improvements.

—Select a technology strategy, encompassing all important technologies, that reinforces the enterprise's overall competitive strategy.

Getting Started

Organizations intending to manage technology must recognize that certain skills are necessary and must be acquired if not internally available. Technical professionals should be given opportunities to broaden their horizons by gaining additional experience in a multiplicity of technology functions as well as dealing with users of their own technology. The managerial attributes deemed highly desirable for managing technology are as follow.

—An understanding that technology exists to serve the interests of the enterprise and is expected to make a contribution to the success of the enterprise.

—A solid technical contribution track record in research, development and manufacturing with a focus on technology approaches that meet the needs of the user.

—A broad interest and knowledge of a broad area of science and engineering technologies; knowledge and understanding of where and how those technologies could enhance the performance of the enterprise.

—A working knowledge of the principles embodied in low-risk disciplined engineering and associated best business practices. Within the Department of Defense (DOD) two publications, *DoD 4245.7-M, Transition From Development to Production*, and *Solving the Risk Equation*, and companion supplement *NAVSO P-6071, Best Practices*, have been developed and define engineering and business practices conducive toward attaining a low-risk development effort.

—A fundamental grounding in management theory and practice as well as related areas of finance, business law and quantitative methods; enabling effective use of powerful management tools, such as the Venture Evaluation and Review Technique, which facilitate the conduct of early trade-off evaluations to enable screening out infeasible technology alternative.

—A knowledge of the business unit and the industry and its competitors.

— An understanding of the global situation (In the Army, the logistics and acquisition management program of Army Acquisition Corps graduate would have a comparable breadth and depth of background).

—An innate desire for continuous learning and exploration; the creative generalists who synthesize business and technology.

—The ability to work with people at all levels; to communicate in an understanding language; to put integrity as the top priority for success.

—An ability to manage and operate within an employee-empowered group. The ironfisted autocratic individual may make an excellent battlefield commander, but is an impediment to stimulating individual team-member resourcefulness needed to create a synergistic developmental environment. The technology manager must demonstrate a working knowledge of the four key concepts that have to be put in place to realize effective employee empowerment.

1) *Authority and Responsibility.* A common complaint, particularly at lower-organizational levels is "I don't have the authority to do...." and a common excuse is, "that's not my responsibility."

2) *Knowledge and Skill.* It does little good to delegate authority and responsibility if the empowered person does not have sufficient knowledge or skill to make a sound decision.

3) *Adequate and Timely Information.* The eyes and ears of the organization assimilates the information it gathers and transmits it to constituents. It lets them know what is going on and whether what they are doing is making a difference.

4) *Confidence and Self-esteem.* Organizations are created on the premise of power differentials from top to bottom. Self-esteem nurturing and confidence building are not enhanced by the enforcement of power differentials, but rather by the development of personal relationships. Everyone arrives at the workplace with five unspoken relationship-enhancing requests. a) Hear me. Listening is a way to show that one's input is valuable. b) If you disagree with me, don't make me a bad person. Concentrate on the idea, not the person. c) Acknowledge my abilities. By using my unique capabilities, an organization gains an advantage. d) Look for my good intentions. Focusing on good intentions, even in the midst of mistakes, encourages innovation and risk-taking. e) Tell me the truth. Hearing the hard truths about ourselves, helps us grow. The best managers and coworkers confront people with hard truths in a skillful, positive manner.

Implementing Technology

Many foreign manufacturers and recently a few isolated U.S. firms have demonstrated an ability to design and launch competitive products in significantly less time than is typical of mainstream corporate America. These firms have organizational and employment policies quite different from those typical of the United States. For example, senior technical employees are considered valuable assets to the design, development and production process and are often given guru status. However, similar persons in this age group in the United States are typically shunted into nondemanding roles and/or urged to consider early retirement.

These rapid-product-development firms typically operate technology developmental efforts within a simple three-layer structure. Top-level management (level 3) forms design and manufacturing teams under the project leader guru (level 2) which works as a united, interdepartmental design group (level 1). This empowered team makes all daily design decisions required to keep the project on schedule and within cost and performance constraints. Top-level management forms the team and sets broad project cost, schedule and technical achievement goals that are periodically assessed at key milestone review points. Team members are characterized as the best of the breed, maintaining their skills at the appropriate technical society's "certification level"; i.e., the cutting edge of technology. Team members generally are placed in face-to-face contact so that problem resolution is quick, efficient and completed in a smooth nonantagonistic, nonbureaucratic manner.

This rapid-product-development mode of operation is in sharp contrast to the predominate U.S. system of numerous disjointed management layers enmeshed in interdepartmental approval-chain power struggles. Today's U.S. managers seem preoccupied with personal power attainment, which is in contrast to their fathers' preoccupation with delivering next-generation technology to the market place.

European Airbus Industrie Corporation is an example of a rapid product-development firm. Using a simple guru-lead empowered design team structure, Airbus was able to introduce its initial A-300 twin jet model several years before Boeing responded with its 7o7 aircraft. As a result, Airbus captured a significant part of the total wide-body market even though Boeing originated the concept and basically dominated the market until Airbus launched the A-300.

Artificial Intelligence Future Impact on Implementing Technology

Most enterprises focus on product drawings as the principal repository for technical data. Historically, this level of detail proved to be inadequate. Artificial Intelligence (AI) will significantly aid the design process by automating the collection and associated inference retrieval of engineering design information at its source. These systems will enable collecting "ideas" and the associated trial-and-error results of those ideas. Often, such decision support information is lost over time. For example, 5 years after an assembly was developed, engineers modifying it may "reinvent the wheel," even mistakenly alter the functional design. By capturing the reasons for a particular design decision at its source, inaccuracy and later expense can be avoided when installing next-generation technology.

Another example of the type of AI design support tool most likely to emerge is the ability to capture the knowledge embodied in engineering disciplines in a "concurrent engineering" expert system. This expert system would enable cross discipline trade-offs like electrical apparatus vs. mechanical apparatus, higher levels of logistics support vs. designing in higher levels of machine reliability, availability, maintainability, etc. It will enable decision-makers to make interdisciplinary trade-offs, providing a real-time capability for making truly integrated and concurrent design trade-offs. The concurrent engineering expert system would include a manufacturing engineering component which features an emulation capability for conducting throughput performance

testing of computer-integrated manufacturing and flexible manufacturing systems layouts. It would be able to select candidate-standard parts from a contractor-certified parts list or, for DOD, the Defense Logistics Agency standard-parts list. It would provide superimposed computer design images of the standard part over the part being designed, to enable real-time part tailoring. This AI system would use the Product Data Exchange using STEP data files to enable data transfer among diverse computer-aided design, engineering, manufacturing, inspection, and testing (CAD/CAE/CAM/CAI/CAT) systems. (STEP is the international standard for the exchange of product model data.) It would conduct process planning for piece parts, group technology of similar parts, production-line scheduling, and material requirements planning.

Virtual Reality Future Impact On Implementing Technology

Virtual Reality (VR) would facilitate viewing the interrelationship of parts in terms of how well they interact to perform their function and how readily they can be assembled and disassembled. The VR has the potential to provide the designer an X-ray and a normal 3-D capability to get animated views of the mechanisms being created. Harnessing and tailoring this capability to aid the animation of assembly and disassembly operations would provide a major step in simplifying maintenance operations and in attaining design simplification. Design simplification usually translates into fewer, less complex and more robust parts, resulting in a higher level of utilization of the manufacturing process equipment and a higher quality product. The VR would provide a means of facilitating the analytical steps the engineer must complete to ensure a design meets or exceeds the criteria of design for manufacturability and assembly.

The VR coupled with AI engineering algorithms may provide such a high level of animation and analytical sophistication that hardware prototypes would no longer be required. The VR would enable functional testing while AI would enable endurance testing. The usability, quality and longevity of the product may be ascertained "on the tube," without cutting any metal.

Concluding Remarks

Managing technology is a major enterprise responsibility. If it sounds complex, it is; but, it is no more complex than most other issues facing the enterprise today. Managing technology is no mystery. However, in the United States, it tends to be the part of the business that generally does not receive the competent leadership needed to keep the enterprise competitive. Rigorous application of the concepts and ideas presented in this article could help reverse that trend. I hope the United States won't have to wait until the next generation of managers before these fundamental management concepts can be implemented.

As Dr. W. Edwards Deming observed, Japan moved from being the ridicule of quality to the standard of quality only after a new set of managers applied in earnest his quality principles.

References

1. Alexander, Philip (1992) "Empowerment...Slogan or Operating Principle?" *Journal for Quality and Participation.*

2. Betz, Frederick (1987) *Managing Technology: Competing Through New Ventures, Innovation, and Corporate Research.* Prentice-Hall Inc., Englewood Cliffs, N. J.

3. Boothroyd, G. and Dewhurst, P. (1989) *Product Design for Assembly,* Boothroyd and Dewhurst, Inc., Wakefield, R.I.

4. Deming, W. E., (1989) *Out of the Crisis* MIT Press, Cambridge, Mass.

5. Edosomwan, Johnson A. (1986) "Managing Technology in the Workplace: A Challenge for Industrial Engineers," *Industrial Engineering.*

6. Meredith, Jack (Editor) (1986) "Justifying Manufacturing Technology," *Industrial Engineering Management Press,* Atlanta, Ga.

7. Merry, Uri (1977) *Developing Teams and Organizations,* Addison-Wesley, Reading, Mass.

8. Moeller, Gerald (1982) *Network Analysis for Management Decisions,* Kluwer Nijhoff, Boston, Mass.

9. Moeller, Gerald (1991) "Templates and Best Practices Use In the Army," *Program Manager,* Journal of the Defense Systems Management College.

10. Poter, Michael E. "How Competitive Forces Shape Strategy," *Harvard Business Review,* March/April 1979.

11. Quinn, J. B. (1988) "Innovation and Corporate Strategy," *Reading in the Management of Innovation,* Second Edition, M. L. Tushman and W. L. Moore, (editors), Ballinger.

12. Rinschler, Gordon (1992) "Teamwork in Engineering: The LH Experience," presentation given at Institute of Industrial Engineers Fall Conference.

13. Reich, Robert (1992) "Made in America," Public Broadcasting System Documentary.

14. Ziemke, Carl and Spann, Mary (1991) "Warning: Don't Be Half-Hearted in Your Efforts to Employ Concurrent Engineering," *Industrial Engineering.*

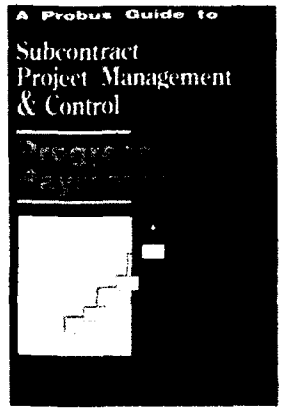
Subcontract Planning and Organization: A Probus Guide to Subcontract Project Management and Control

by Quentin W. Fleming and Quentin J. Fleming, Probus, Chicago, 1993, pp. 269.

Subcontract Planning and Organization, the latest title published by the father-son team of Fleming and Fleming, is the flagship book for a series that promises to demystify the art of subcontracting and subcontract management. It provides a superb overview of the systems subcontracting process noting that each subcontract is a "project," by itself, best managed by using project management techniques.

The text's DOD orientation shows up at the beginning, where the Flemings describe "program" phases involved in major system acquisitions and how subcontracting fits in. They define their concept of subcontract management followed by segments on organizational modes and responsibility charters, including a timely piece on subcontract management within integrated product teams (IPTs). There is an extensive discussion of "teaming" in the context of joint-contractor relationships including legal issues and practical business considerations, supplemented by a suggested teaming agreement questionnaire.

The make-or-buy process is overviewed along with complementary material regarding source competition; how one gets it and stays out of trouble. Risk management is an inherent part of the process and the authors provide a broad perspective on this issue. They provide a sound approach to subcontract risk management and add insight via a description of the DCAA (Defense Contract Audit Agency) risk-assessment model. The last two chapters deal with contract types and preparing subcontract management plans; the latter an excellent summary of the overall process, tying loose ends together. There is an extensive glossary of unique terms.



The authors provide examples and draw from professional literature to make this an excellent source book.

If you manage a large project or have an interest in the subcontracting process, reading this book will be time well spent.

Robert E. Feldan
Torrance, California

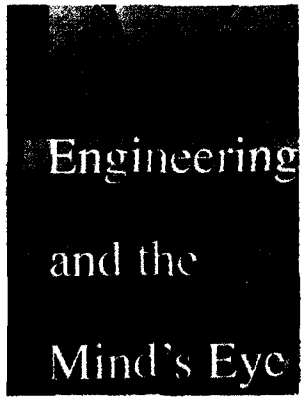
Engineering and the Mind's Eye

by Eugene S. Ferguson, The MIT Press, Cambridge, Massachusetts, 1992.

"It is important for all of us to understand how engineers choose and plan the changes they make, because engineers have an effect upon the kind of world we live in out of all proportion to their numbers," page 1, *Engineering and the Mind's Eye.*

Dr. Ferguson's book documents the history of nonverbal learning and nonverbal understanding in the development of engineering. The author presents a brief history of engineering and how the education of engineers has changed during the years.

He describes how U.S. engineering schools moved away from teaching, how to make engineering drawings and the use of hands-on laboratory exercises in favor of the mathematically oriented, analytical engineering sciences. Theory became more glamorous than practice. Scientists profited at the expense of engineers. As a result, engineering faculty desired to become dilettante scientists rather than practitioners. Engineering faculty soon became hired on academic credentials rather than on actual engineering expertise. Engineers became focused on "know why" rather than "know how."



Engineering faculty, being human, taught and graded students according to what the faculty did best; i.e., theoretical mathematical analysis rather than design and manufacturing. Design and manufacture were seen as too ambiguous, too hard to grade, too unsophisticated, and too time-consuming to teach. As a result, engineering students became very good at analyzing structured, unambiguous math-oriented problems and very poor at designing new systems and very poor at manufacturing. As a result, engineering faculty and engineering students in the United States became focused on an imaginary well-structured mathematical world instead of the complex real world. Ferguson's premise is the quality, and competitiveness of U.S. products and companies have suffered as a result.

I recommend this book to anyone interested in the practice of engineering and especially to engineers who wish to understand their profession better. Ferguson raises questions for all individuals interested in how the United States can improve its economic competitiveness.

William T. Motley, Chair, FD-MM
Defense Systems Management College

TECHNOLOGY

CHANGING ROLE OF GOVERNMENT LABORATORIES:

Improving U.S. Industrial Competitiveness

Dr. Joseph W. Lee

The United States emerged from World War II as the dominant economic, technological and political power. Today, the inability of U.S. industries to compete effectively in global markets is causing congressional and presidential concerns about our economic and technological leadership.

Facing strong competition from Asia and Europe, the United States must strive to regain economic and technological leadership. Since technological innovation is one of the major sources of competitive advantage, the federal government must actively formulate policies and programs which sustain U.S. industry's abilities to innovate and expedite the technology commercialization process.

Dr. Lee is President of International Consulting Services (ICS) which provides analysis on the development and the application of aerospace, aviation and information system technologies. He held engineering, management and consulting positions with leading aerospace and high technology companies and conducted research on technology management/transfer.

Dr. Lee is grateful to Dr. Richard Van Atta, the Institute for Defense Analyses, for reviewing and making suggestions on this article.

President Bill Clinton addresses the crew of the aircraft carrier ***USS Theodore Roosevelt (CVN-71)*** *off the coast of Norfolk, Virginia.*

Government laboratories are a potential asset for meeting this national challenge. The changing world environment in the post-Cold War era presents new opportunities and challenges for government leadership and decision-making. Three dimensions of change will affect government laboratories: (1) global security related to the collapse of Soviet threat and demise of nuclear strategic weaponry; (2) decline of U.S. economic and technological leadership; and (3) defense downsizing related to national security and budget deficit. These changes will have major implications for future requirements and directions of government-funded laboratories.

(US Navy photo by PH1 Bob McRoy.)

> ***"In order to implement an effective U.S. technology policy, I will declare that U.S. technological leadership is a national priority and organize the government for results."***
>
> ***—President Clinton***

U.S. Technology Strategy

The defense budget reductions and the decline of U.S. technological leadership raise fundamental concerns about the nation's technology base and industrial base. Because government laboratories are one of the largest segments of federal technology expenditures, we need to reorient policies to meet these challenges.

As a step toward meeting these challenges, President Bill Clinton is developing a specific set of policies and programs for revitalizing the nation's competitiveness posture — to focus on the importance of commercial technology development and its application. He stated in *Technology: The Engine of Economic Growth*, September 18, 1992, "In order to implement an effective U.S. technology policy, I will declare that U.S. technological leadership is a national priority and organize the government for results." His technology strategy contained two broad initiatives that will have direct impact on funding and direction of government laboratories:

—Reforming federal R&D programs to focus on critical technologies such as advance materials, information technologies and new manufacturing processes to enhance industrial performance, and

—Leveraging the existing federal investment in technology to maximize its contribution to industrial performance.

Reports containing ideas for improving technological competitiveness have been issued recently by such organizations as the National Academies of Sciences and Engineering; the Competitiveness Policy Council, the Carnegie Commission on Science, Technology and Government, the private sector Council on Competitiveness, and the National Science Board. It is likely that the recommendations of these organizations will receive considerable attention by the Clinton administration. These reports recommend substantial changes in the substance and structure of policies affecting technology research, development and application. Some of the key recommendations made in these reports include:

—Changing the role of Advanced Research Projects Agency (ARPA) to refocus government programs and priorities to foster a "national technology base," redefine defense technology development activities, and direct ARPA to support dual-use technologies to "bolster commercialization efforts in the civilian sector." (Because ARPA's basic mission is advanced research focusing on breakthrough technologies for military applications, extending its role to support private sector technology commercialization efforts could decrease its effectiveness.)

—Developing "a new mechanism for government and industry to work together and promote the development of generic pre-competitive technologies that are not being financed by the private sector." (R&D funding should be reallocated from defense to commercial applications. The budget deficit has created an urgent need for our government to quickly reallocate, refocus and redirect the nation's finite resources for increasing technological capabilities to support industrial competitiveness. This concept is slowly making progress; therefore, funding for Department of Commerce's Advanced Technology Program should be increased.)

—Establishing a Civilian Technology Corporation to undertake investments in pre-competitive technologies that have high social values but with a rate of return too low to be undertaken by private firms. This approach could be a substitute for a civilian ARPA, but there are substantial difficulties with its implementation. For example, well-defined policies and operating procedures would be needed to justify the choices of technology. Consensus building and national debate on social values could delay development for years. The technologies most likely to justify consideration by such an approach would include energy conservation (fuel efficient vehicles and environments), education and training systems (simulation and interactive concepts) and technologies related to public safety.

Congressional Initiatives

Recognizing that government laboratories are a potentially rich source of scientific knowledge and technical innovation, Congress has passed several pieces of legislation — The Stevenson-Wydler Technology Innovation Act of 1980; The Federal Technology Transfer Act of 1986; The Omnibus Trade and Competitiveness Act of 1988; The National Competitiveness Technology Transfer Act of 1989; and National Defense Authorization Act of 1991. These Acts were designed to optimize the use of tax dollars for government R&D; encourage government-industry cooperation in technology development; reduce barriers in the technology transfer process; and increase incentives for industry to participate in cooperative R&D, consortia teaming and other agreements. Unfortunately, reports to Congress indicate that technology transfers from government laboratories to the private sector have achieved far less than was expected.

Congressional hearings and research reports (including one I submitted to Congress) have documented legal, behavioral and informational impediments to the technology transfer process. My report includes findings and recommendations from a survey of the Technology Transfer Society membership. A 53 percent response rate was received from members representing government, industry and academe. Thirteen significant impediments, with a consensus of more than 70 percent, were identified in three categories.

Impediments Related to Policy Issues

—Industry is unwilling to take risks in technology development unless there exists a competitive advantage or it fits into the company's strategic plans (95 percent agreed)

—Government should not be involved with technology transfer, because it is industry's responsibility to develop it's own technology *(94 percent disagreed — indicating a need for government leadership and industry policy)*

—Government-developed technologies might be useful but often are not immediately compatible with industry needs (86 percent agreed)

—The problem is, government laboratories do not focus on commercial R&D because they have different missions (86 percent agreed)

—Funds designated for technology transfer are inadequate to carry out the government's objective of increasing the flow of technology to industry (76 percent agreed).

Impediments Related to Information/Marketing Issues

—Ineffective government-industry communications have impeded efforts to inform industry about federal technologies (81 percent agreed)

—Government has not been effective in informing industry of its technologies that have potential commercial values (81 percent agreed).

Impediments Related to People/Management Issues

—Government lacks technology management expertise for technology transfer (88 percent agreed)

—Government bureaucracy is too cumbersome and difficult to deal with *(85 percent agreed)*

—Cultural differences between government and industry have negatively influenced their working relationships (80 percent agreed)

—Industry needs to overcome the "not-invented-here" syndrome mentality (78 percent agreed)

—Industry lacks technology management expertise for technology transfer (76 percent agreed)

—The problem isn't primarily due to a lack of government actions; it is also due to the lack of interest and motivation on the part of management (in industry) for federal technology (74 percent agreed).

Since publishing the above findings in 1990, government laboratories have made considerable progress

through cooperative research and development agreements (CRADAs) as a mechanism to enter into technology cooperation with industry. Both 1989 and 1991 Acts have removed additional legal barriers and certain obstacles by (1) allowing government-owned, contractor-operated laboratories to enter into agreements with universities and industry via CRADAs, and (2) providing incentives to defense laboratories to enter into a contract or partnership agreement with small businesses. However, it has become clear that these agreements and relationships cannot proceed at the speed planned without additional government and private sector funding to carry the R&D to the next level. These challenges require creative approaches and effective decision-making in a period of budget deficit and defense downsizing.

It should be noted that the R&D budget was $15.4 billion for defense and $17.6 billion for nondefense in 1980. By FY 1993 the R&D budget had increased to $43.3 billion for defense and $32.5 billion for nondefense (an increase of 27.9 percent for defense and 14.9 percent for nondefense). Today, the budget for government laboratories is approximately $22 billion annually (source: Council of Competitiveness). The largest budgets for these laboratories are: Department of Defense - $7 billion; Department of Energy - $6 billion (three fourths of which is for defense R&D); Health and Human Services - $3.4 billion; National Aeronautics and Space Administration - $3.3 billion. The remainder is spread among other government departments and agencies. *The government must refocus R&D spending patterns and redirect national resources to meet the challenges of an increasingly competitive global environment.*

Impact on Government Laboratories

National laboratories need to refocus their missions and orientations in the transition from defense (military) to civil (commercial) economy. In order to contribute to industrial performance and overcome the technology transfer impediments listed above, *the government laboratories need to redirect resources and reallocate funds from military expenditures for commercial application of technology.*

Recognizing that change can be difficult and could be a disruptive process, government must provide the leadership for developing coherent plans of action to ensure an orderly transition of government laboratories in terms of jobs, skills and facilities. Some laboratories have already adopted a leadership role in seeking new missions to justify their existence but, ultimately, government must downsize, consolidate and close down redundant and obsolete facilities (much like what the private sector has been doing). The 103rd Congress (Committee on Science, Space and Technology, U.S. House of Representatives) is conducting hearings on the National Competitiveness Act of 1993 to address technology and competitiveness issues. The challenges facing the Clinton administration and new Congress include the need to address five imperatives:

—Reallocate or consolidate resources in government laboratories to focus more on the commercial application of technology

—Increase funding for technology cooperation and transfer between government-academe-industry using funds recovered from closing redundant and out-of-date laboratories

—Decentralize decision-making to allow laboratory directors to plan and implement their own strategies (and be accountable) in supporting the commercial application of critical technologies

—Integrate private sector concerns and expertise into the national technology policy-making process

—Establish mechanisms within the executive branch for developing and coordinating a comprehensive national technology strategy and manage its implementation.

In addition, the Department of Commerce should be reorganized to fit the strategic requirements of the 21st century. We must develop the infrastructure (organization, systems and skills) to systematically monitor and evaluate the commercial merits of technology; its state of development by foreign competitors; its implications on technology transfer to industry; and its long-term impact on trade, economic health and U.S. industrial competitiveness. We need to integrate the defense infrastructure to complement the private sector technology base and the industrial base in response to global changes. These changes dictate new thinking to seek different approaches for solving 21st century problems. In this regard, the R&D programs within more than 700 government laboratories, representing taxpayer investment of about $22 billion annually, must be either refocused or substantially cutback.

The challenge to President Clinton is to make the difficult decisions in developing technology and industrial policies focusing on improving the U.S. technology and industrial bases to achieve sustainable economic leadership.

(A summary of this article was published in ***Aviation Week and Space Technology*** *in December of 1992. President Clinton's Technology Reinvestment Project allocating almost $500 million for government-industry partnerships to develop dual-use technologies is a good start. This is evidence of technology policy in the making. However, like many projects and initiatives in the past, success will require policy implementation skills. Anything less will mean unmet goals and objectives.* ***JWL)***

TEST AND EVALUATION OVERSIGHT

Total Quality Trust Model

Lieutenant Colonel Jeffrey R. Riemer, USAF

This manuscript concerns why the Department of Defense has oversight, strategy of the oversight agency, program-office strategy to deal with the oversight process, and good and bad aspects of oversight. It concerns how application of a Total Quality Trust Model may improve the test and evaluation (T&E) oversight processes.

I present these assumptions. When referring to testing, developmental testing (DT) and operational testing (OT), oversight will be grouped together, except where differences require specific reference. The Office of the Secretary of Defense (OSD) primarily will be used as "oversight agency"; the program office is the primary agency being "oversighted." I present a view of perspectives of the oversight agency, and perspectives of the agency being oversighted.

Why We Have Oversight

The development scenario usually starts with both limited time and funds. Optimistic schedules and uncertain funding generally inhibit program offices from meeting their original cost, schedule and performance goals, which creates programmatic risk. This risk is further aggravated by requirements imposed by the acquisition process, which are intended to successfully field a system under development. For instance, constraints are imposed on programs to test a system against the expected enemy threat, but insufficient investments have been made in the T&E infrastructure to provide the resources to test.

Funding profiles have made it difficult to accomplish all necessary tests to satisfy imposed requirements. The shortfall in the process has been in resolving the impact of compressed schedules, combined with uncertain funding, on the reality of accomplishing all imposed requirements.

Therefore, conflicts naturally exist between what is required by the acquisition process, and what can be realistically accomplished. The presence of this conflict during execution of a program warrants the oversight process. The choices made to resolve conflicts bear watching.

Strategy of the Oversight Agency

Strategy of the oversight agency starts with ensuring a program has an adequate test and evaluation master plan (TEMP). Although the Deputy Under Secretary of Defense for Acquisition/Developmental Test and Evaluation (DUSD(A)/DT&E) and the Director of Operational Test and Evaluation (DOT&E) get involved with aspects of a program before the Demonstration and Validation Phase (Milestone 1), the primary involvement of T&E oversight comes with preparation and submission of the first TEMP. The DUSD(A)/DT&E and DOT&E are responsible for ensuring the TEMP lays out an executable test program to provide answers whether or not the system tested meets its performance requirements; test results indicate acceptable risk to proceed with development; and results support the system as being effective and suitable to perform its mission. The TEMP becomes the test program's strategic planning document.

Before February 1991, TEMPs were approved by OSD with the mindset that major problems in the TEMP needed to be corrected before approval, but minor problems and problems that had time to be worked could be forwarded to the Services in the form of comments. If comments were addressed and resolved in the next annual update, things proceeded in a positive manner.

After February 1991, the TEMP approval cycle changed from an annual requirement to one corresponding to milestone reviews. Although there are provisions for requiring TEMP approval between milestones, the change has extended the time between approvals, which then generated a change in oversight strategy. The rigor of the TEMP review process has increased, and flexibility to approve

Lieutenant Colonel Riemer is Commander of the 4953d Test Squadron, Wright-Patterson Air Force Base, Ohio.

TEMPs with additional comments has decreased. For OSD to approve a TEMP that may not be returned for additional approval for up to 3-4 years, they need to be more critical of the document. For example, if a TEMP lays out a plan to test the system against unavailable enemy threats, it is important to ensure development and acquisition of test resources have been funded and the schedule will accommodate requirements for testing. If needed resources will not be available, the TEMP needs to explain the proposed alternative to test the system adequately. This overall change in strategy, which requires closure on issues that previously were worked on-line between annual reviews, makes the TEMP approval a more significant obstacle.

Once testing starts, the oversight strategy is to monitor tests, analyze results, and assess risk, performance, effectiveness and suitability. Monitoring tests is important to ensure methods and limitations placed on the testing provide relevant data. After analyzing and comparing results against specific performance thresholds and exit criteria, a risk assessment is performed to evaluate if the results warrant, from a technical perspective, proceeding to the next milestone. The technical risk assessment is more from the DT side, whereas the OT side provides an assessment of the system's effectiveness and suitability to accomplish the mission.

With the TEMP as the test program's strategic planning document, oversighters use it as a contract with the program office to ensure testing stays on track. If deficiencies occur during testing, oversighters ensure corrective action is taken and that retest results keep the risk level acceptable to continue the program.

Strategy of Program Office to Deal with T&E Oversight

Most program offices use a strategy of minimizing bad publicity; for TEMP approval, it is to lay out a conceptual plan taking advantage of available test resources when needed. The need to stay conceptual, rather than specific, prevents the program office from committing to something not available when needed. Since many things the program office will need to test its system adequately are not funded through its program, the program office is left in a corner. The dilemma is, if the program office is specific and says it needs a certain resource to test the system, and the resource is not available, that office will be hammered for inadequately testing the system.

Programs feel pressured into being as vague as possible in their TEMP to prevent problems. The annual TEMP review process allowed a way to address problems like this at a later date; the new approval cycle makes it difficult to define required test resources when their availabilities are not defined. Oversighters are asking program offices to make commitments they will be unable to keep.

Once testing begins, most program offices' strategy is to control access to test results. History has shown that if too many deficiencies appear in a test program, the funding starts to disappear. Testing is accomplished to make sure the system meets specifications, and is effective and suitable to perform the mission. Fixing deficiencies will cost money, which is going to be reduced. Therefore, individual deficiencies are downplayed, with the intent of finding a solution before they create a major problem and result in funding losses. This "optimistic filter" that makes problems sound insignificant may or may not work, depending on political interest of the program.

As the program nears a milestone review, the program office strategy must change. If the program office is perceived as hiding information, the program can be hurt. Therefore, normally the program office starts to loosen its grasp on information, and results begin to flow when the oversighters' workload peaks and flood gates open and saturate them. This massive amount of information allows the program office to say it gave oversighters everything, and prevents them from determining validity of the information. Not that the program office would intentionally mislead the oversighters but, at this point, information has been through the filter, so that results paint the best picture possible. This exceeds strategy and becomes tactics. The result is decision-makers may have filtered information regurgitated back rather than a totally independent look at results.

Good Points about Oversight

From the oversighters' perspective, if their process is conducted in the manner established, it can help a program through the complex acquisition maze. After looking at many programs from different Services, the oversighter can identify potential problems and pitfalls that hurt previous programs. The oversighter can provide valuable insight across the spectrum of the developmental process.

This approach provides a balance between what is necessary in a program and what is totally ineffective. The oversighter's goal is to act as a protection device filtering overly optimistic program managers from bringing forward a picture that may cloud the decision-maker's perspective of a program. Another critical function of the oversighter's job is to identify for program offices, as early as possible, all problems it will have getting a program through the process. This will give the program office time to work problems and develop solutions early, minimizing impact to the program schedule.

Without this approach, tunnel vision prevails and surprises surface too late, which usually results in delays and added cost. The oversighter cannot eliminate problems but can identify problems early to be worked.

A good oversighter will assist a program during the planning stage to develop a workable plan. When testing begins, good news should be elevated and bad news should be dealt with up front, letting the program office know what it is up against.

From the program-office perspective there is not much good to be said about oversight received from OSD, General Accounting Office, and the Department of Defense Inspector General. Program offices spend much time and resources responding to questions and accusations, which prevents managing the programs. I think most program managers would agree with "Don't manage my program for me, just let me do my job."

On the other hand, the program office is oversighter for the contractor; its perspective changes, based on whether or not it is doing the oversight; or it is being oversighted. Program offices see good in their oversight of the contractor by saying they are the government watchdog to see that contractors provide what was promised regarding cost, being on schedule and performance.

Bad Points about Oversight

From the oversighters' perspective, there are not enough people to provide the type of service oversighters prefer. When a single action officer oversights 50 programs, there is virtually no way a person can provide adequate service to all programs. On the DT side, there is no direct test representation on the Defense Acquisition Board (DAB), which limits effectiveness of DT impact on the process. This makes it more difficult for DT oversighters to get the attention of program offices, which know their real measure of success is usually based on OT's report to the Congress. In early stages of the program, the most can be done to affect a program positively, so more emphasis needs to be put on early DT oversight. The recent change of DT&E from a position under the Director of Defense Research and Engineering (DDRE) to the Under Secretary of Defense for Acquisition (USD(A)), is a step in the right direction; however, DAB representation and sufficient manning issues need to be addressed.

From the program office perspective, there are complaints about OSD oversight. The biggest complaint may be that OSD always is changing rules. As one problem is resolved, another crops up. The OSD never seems satisfied. People doing the oversight are sometimes not familiar with the program to make meaningful inputs, which wastes everyone's time. If program offices take time to educate action officers, they are potentially subjecting themselves to headaches from action officers learning just enough to be dangerous. Another problem is that everyone seems to have a "pet rock," and as they fix one concern, a new person finds something else. Finally, action officers are so busy with other programs that inputs to the program office arrive too late to be constructive. Program offices keeping an open dialogue with the oversighter find everything is okay until just before the milestone review, when oversighters reveal big problems.

The Trust Model

Can We Improve the Process?

Most problems and many reasons for opposing strategies and perceptions of what is good and bad concerning the oversight process stem from a lack of trust among players. The OSD does not trust program managers and program managers do not trust OSD. Both sides can cite multiple reasons for not trusting each other. However, in the spirit of total quality, new emphasis has been placed on the importance of making and keeping agreements, establishing credibility with customers, and working in an atmosphere of openness. This leads to trust among the players, and improvements in conducting business is possible. This Trust Model (Figure 1), developed by The Atlanta Consulting Group to improve organizational effectiveness, can be applied directly to the T&E oversight process and all oversight.

Making and Keeping Agreements

No Fuzzy Agreements. This starts with establishing requirements that are realistic and necessary, and making sure there is an acceptable way to test the requirement. If verifying a requirement involves modeling and simulation vs. actual testing of hardware, get "buy-in" upfront so that oversighters agree with the approach. Then, develop a TEMP that clearly defines the test program. State what is required to test the system adequately, state the current test limitations honestly, and provide alternatives to overcome limitations. If done from the start, this will prevent last minute "knee jerks" approaching a milestone review.

Only Make Agreements You Can Keep. Do not lay out a program that is inexecutable, because someone says it has to be done for a certain cost or by a certain time. If the cost and time constraints are unrealistic, it is logical to assume it will take longer and cost more to execute the program correctly. Be truthful at the start; do not say it cannot be done but, instead, say, "this is what it will take to do it right, and here is what will not be done if only given limited funds and time." If needed resources are not available, get a commitment from the authority to provide the resources, or provide money to obtain resources. The OSD should take a more active role in making sure the T&E infrastructure is there to test systems being developed. How can testing requirements be established that cannot realistically be accomplished? *Be realistic.* The Congress needs to know how much it really costs to do T&E correctly; for every dollar they cut from the program, they need to realize some-

thing will have to be omitted. Testing should be prioritized to make clear what will, and will not, get tested for a given funding level.

If You Can't Keep an Agreement, Give Notice Immediately. When a problem exists affecting a previous agreement, make it known and provide an alternative solution along with its impact on the original agreement. As oversighter, if rules change due to changing legislation or policy, let program offices know, as soon as possible, what the expected impact will be on their programs. When changes occur, do not expect originally agreed-upon deliverables to be provided without a request for more money and time to accomplish them.

Clean Up Broken Agreements. Once the original plan is determined to be unworkable, establish a new agreement that will work given the current situation. If this is not accomplished, delays probably will occur.

Credibility

You Can Be Depended On. Tell the truth; do not hide information; and do what is agreed upon. By demonstrating integrity, credibility will be gained. This goes for everybody involved.

Treat Each Other with Fairness and Respect. Treat truthfulness with respect and do not misuse information. If knowledge of problems directly translates to an adverse action for the source, the credibility needed to make the system work will not be gained.

Openness

Being Truthful. Does it sound as if I am repeating myself? Well, I am! Telling the truth can mean different things to different people. Some feel if asked a question and the reply does not contain a lie, the truth has been told; others feel if something is known and nothing is said unless specifically asked, the truth is not being told. Both can be right to an extent but they differ in their openness. If being open gets people in trouble, they probably will revert to not lying and not being open. Both sides must be open and truthful.

Listening and Believing. Everyone is leery of the phrase, "We are here to help you." Why don't we believe them? Because we usually do not trust them. Our memory tells us we were hammered the last time we told someone something. If they would say "I am here to find out what you are doing wrong," maybe we would believe them. The leadership and decision-makers should look at write-ups and deficiencies from a positive side. For example, "I am glad they found what was wrong, so we can fix it before it becomes a bigger problem." If problems in a test program were addressed from this perspective, we would have less funding instability. Maybe we should program funds to handle problems, based on program risk, rather than scramble and take funds from another area where they are needed; this only moves the Band-Aid. If things go well, the program may come in below cost. Program offices must listen and believe that if they downplay and hide problems that surface when they are too difficult to fix, the future of their programs may be in jeopardy. Both sides need to listen to issues and believe they will not disappear with time.

FIGURE 1. Trust Model

Trust
- Openness
- Being Truthful
- Listening and Believing
- Admitting Mistakes

Credibility
- You Can Be Depended On
- Treating Each Other With Fairness and Respect

Making and Keeping Agreements
- No Fuzzy Agreements
- Only Make Ones You Can Keep
- If You Can't Keep An Agreement, Give Notice Immediately
- Clean Up Broken Agreements

Admitting Mistakes. Come clean when mistakes are made, and present a plan to recover from them. Bound the expectations so leaders know scenarios for the worst case, best case and most probable case. If you learn of a mistake, do not shoot the messenger; focus on the get-well plan and how to prevent future occurrences, not the mistake you cannot change.

Summary

We have to put reality into the planning process and stop saying we can meet unrealistic schedules and costs that we know are unattainable. We must reduce conflicts between what is required and what can be realistically accomplished; and, if something is absolutely necessary, we must fund the program to do it. We need to invest in a T&E infrastructure to support demanding requirements we have imposed on the acquisition process. We must rethink our strategies and develop new ones based on trust and integrity.

Sure, it sounds good—and if we were in Utopia it might exist—but that is not how it works. I contend that for the oversight process to work, each of us must encourage changes from subordinates and superiors when making and keeping agreements, establishing credibility, and being open in our dealings. This would allow us to take a giant leap forward from our present position.

Bibliography

1. DoD Directive 5000.1, "Defense Acquisition," February 23, 1991.

2. DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures," February 23, 1991.

3. Riemer, Lt Col Jeffrey R., "Action Officer Notes," November 8, 1988 - August 31, 1991.

4. The Atlanta Consulting Group, "Trust Model."

GPO BOOKSTORES & RETAIL SALES BRANCH

MAIN BOOKSTORE
710 North Capital St., N.W.
Washington, D.C. 20401
Commercial: (202) 512-0132
Fax: (202) 512-1355

RETAIL SALES OUTLET-LAUREL
8660 Cherry Lane
Laurel, MD 20707
Commercial: (301) 953-7974
Fax: (301) 498-8995

ATLANTA BOOKSTORE
First Union Plaza
999 Peachtree St., N.E.
Suite 120
Atlanta, GA 30309
Commercial: (404) 347-1900
Fax: (404) 347-1897

BIRMINGHAM BOOKSTORE
O'Neill Building
2021 3rd Avenue North
Birmingham, AL 35203
Commercial: (205) 731-1056
Fax: (205) 731-3444

BOSTON BOOKSTORE
Thomas P. O'Neill Federal Building
10 Causeway St., Room 169
Boston, MA 02222
Commercial: (617) 720-4180
Fax: (617) 720-5753

CHICAGO BOOKSTORE
One Congress Center, Suite 124
401 South State Street
Chicago, IL 60605
Commercial: (312) 353-5133
Fax: (312) 353-1590

CLEVELAND BOOKSTORE
Room 1653, Federal Building
1240 East 9th Street
Cleveland, OH 44199
Commercial: (216) 522-4922
Fax: (216) 522-4714

COLUMBUS BOOKSTORE
Room 207, Federal Building
200 North High Street
Columbus, OH 43215
Commercial: (614) 469-6956
Fax: (614) 469-5374

DALLAS BOOKSTORE
Room 1C50, Federal Building
1100 Commerce Street
Dallas, TX 75242
Commercial: (214) 767-0076
Fax: (214) 767-3239

DENVER BOOKSTORE
Room 117, Federal Building
1961 Stout Street
Denver, CO 80294
Commercial: (303) 844-3964
Fax: (303) 844-4000

DETROIT BOOKSTORE
Suite 160, Federal Building
477 Michigan Avenue
Detroit, MI 48226
Commercial: (313) 226-7816
Fax: (313) 226-4698

HOUSTON BOOKSTORE
Texas Crude Building
801 Travis Street
Houston, TX 77002
Commercial: (713) 228-1187
Fax: (713) 228-1186

JACKSONVILLE BOOKSTORE
100 West Bay Street
Suite 100
Jacksonville, FL 32202
Commercial: (904) 353-0569
Fax: (904) 353-1280

KANSAS CITY BOOKSTORE
#120 Bannister Mall
5600 East Bannister Road
Kansas City, MO 64137
Commercial: (816) 767-8225
Fax: (816) 767-8233

LOS ANGELES BOOKSTORE
ARCO Plaza, C-Level
505 South Flower Street
Los Angeles, CA 90071
Commercial: (213) 239-9844
Fax: (213) 239-9848

MCPHERSON SQUARE BOOKSTORE
1510 "H" Street, N.W.
Washington, D.C. 20005
Commercial: (202) 653-5075
Fax: (202) 376-5055

MILWAUKEE BOOKSTORE
The Reuss Federal Plaza
310 W. Wisconsin Avenue
Milwaukee, WI 53202
Commercial: (414) 297-1304
Fax: (414) 297-1300

NEW YORK BOOKSTORE
Room 110, Federal Building
26 Federal Plaza
New York, N.Y. 10278
Commercial: (212) 264-3825
Fax: (212) 264-9318

PHILADELPHIA BOOKSTORE
Robert Morris Building
100 North 17th Street
Philadelphia, PA 19103
Commercial: (215) 597-0677
Fax: (215) 597-4548

PITTSBURGH BOOKSTORE
Room 118, Federal Building
1000 Liberty Avenue
Pittsburgh, PA 15222
Commercial: (412) 644-2721
Fax: (412) 644-4547

PORTLAND BOOKSTORE
1305 S.W. First Avenue
Portland, OR 97201
Commercial: (503) 221-6217
Fax: (503) 225-0563

PUEBLO BOOKSTORE
Norwest Banks Building
201 W. 8th Street
Pueblo, CO 81003
Commercial: (719) 544-3142
Fax: (719) 544-6719

SAN FRANCISCO BOOKSTORE
Room 1023, Federal Building
450 Golden Gate Avenue
San Francisco, CA 94102
Commercial: (415) 252-5334
Fax: (415) 252-5339

SEATTLE BOOKSTORE
Room 194, Federal Building
915 Second Avenue
Seattle, WA 98174
Commercial: (206) 553-4270
Fax: (206) 553-6717